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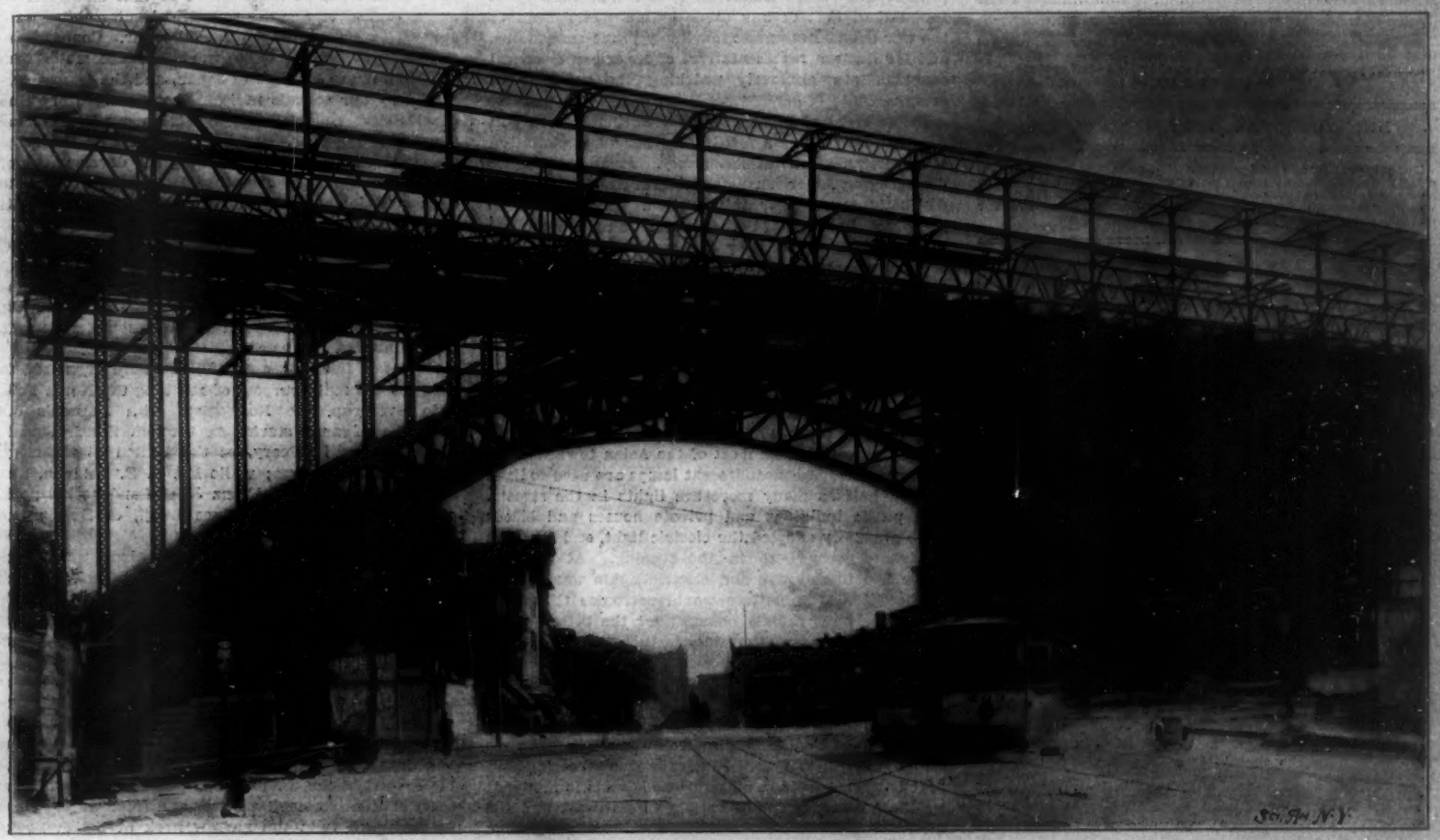

Span of arch, 168½ feet. Maximum rise, 40 feet. Weight of arch and superstructure, 880 tons.

The Arched Bridge and Station at 125th Street.

One of the Skewbacks of the Main Arch.

COMPLETING THE NEW YORK RAPID TRANSIT SUBWAY.—[See page 461.]

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NEW YORK, SATURDAY, JUNE 11, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

GROWTH OF AMERICAN MERCHANT MARINE.

The growth of our merchant marine is slow, and is in no sense commensurate with our phenomenal advancement in manufactures and commerce. At the same time, it is a fact worthy of note that the documented tonnage of the United States on June 30, 1903, for the first time in our history, exceeded 6,000,000 gross tons register, comprising 24,425 vessels of 6,097,345 gross tons. These figures do not include 1,828 yachts of 74,990 gross tons. The total shipping of the United Kingdom for 1902 was 20,258 vessels of 15,357,052 gross tons (vessels of British colonies number 15,533 of 512,268 net tons). On January 1, 1902, the total shipping of the German Empire was 6,024 vessels of 3,503,551 gross tons. The shipping of the United Kingdom and Germany is largely employed in developing foreign trade. The shipping of the United States is almost wholly a part of our domestic transportation system. On June 30, 1903, 5,141,037 gross tons were engaged in transportation and coastwise trade, 879,264 gross tons were devoted to foreign trade, and 67,044 to fisheries. The distribution of our tonnage on June 30, 1903, was: Atlantic Ocean, 3,157,373 gross tons; Pacific Ocean, 812,179 gross tons; the Great Lakes, 1,902,698 gross tons; Mississippi system, 215,095 gross tons. Our shipping on the Pacific has increased more rapidly than on the Atlantic. In regard to motive power, 3,408,088 gross tons were propelled by steam and 1,965,924 gross tons were sailing vessels, and 713,333 gross tons of canal boats and barges were variously propelled. As regards the materials of construction, 2,440,247 gross tons were of iron and steel construction, and 3,647,098 gross tons were of wood.

During the years 1902 and 1903, nearly 100,000 tons of large ocean-going steamers have been added to our registered fleet.

The subject of the losses of vessels from various causes is a most important one. During the year ending June 30, 1903, 487 vessels of 107,084 gross tons were reported.

The very heavy percentage of loss of steamers by fire discloses unsatisfactory attention to duty in the hold or insufficient fire apparatus, or both. For comparison of the relative losses of the merchant shipping of the United States and foreign nations, the most complete figures are those of the Bureau Veritas. They cover only sea-going steamers of over 100 gross tons and sea-going sail vessels of over 50 net tons. The proportion of foreign vessels on the ocean is so great and of American vessels so small that the figures do not clearly disclose the relative security of navigation under various flags and laws. Figures show that American sea-going vessels from 1896 to 1903 have been less liable to accident but more liable to total loss than foreign steamers, while American sea-going sail vessels have been more liable both to accident and loss than foreign sea-going sail vessels.

The losses of both steamers and sail vessels of all nations are due, of course, more to stranding than to any other cause, as it accounts for 47 per cent of the losses of American sea-going steamers and 53 per cent of the losses of American sea-going sail vessels. The losses of foreign steamers are 44 per cent, and the losses of foreign sail vessels 56 per cent. There is a special reason why American vessels are more liable to stranding than the vessels of other nations which conduct the world's deep-sea trade. American vessels are seldom found in mid-ocean on long voyages. Their course is usually along our own coasts in the domestic trade, or in trade with nearby countries. The excellent lighthouse system of the American coast and care in navigation have thus overcome liability to accident from the nature of our trade along the coasts. Collision differs totally from stranding in that, for its prevention, one must look to the navigating officers. The figures show that superior care and intelligence are possessed by the navigating officers of American steamers.

ELECTRICITY IN KOREA AND JAPAN.

Particular attention is called to the development of the electrical industry in Asia by the present war between Russia and Japan, and especially to that part of it which Americans have established. American engineers and capitalists were the pioneers in Korea and Japan in introducing electrical plants for lighting and power production, and even throughout southern Manchuria—the disputed territory that brought on the present war—more American electrical machinery is found than that of any other nation. The effect of the war upon Korea must inevitably prove momentous, and far Eastern representatives of American electrical concerns are anxiously watching the progress of events.

In the event of Japan proving victorious, Korea will undoubtedly become a fertile field for the exploitation of American electrical machinery. Japan, instead of discouraging American manufactures in Korea, would distinctly favor their introduction. It may not be generally known that the largest single electrical plant in Asia was built by an American firm, and that the consulting engineer was a Japanese graduated from the Massachusetts Institute of Technology. This plant is known as the Seoul Electric Company, a Korean organization which holds the property under mortgage. The plant furnishes arc and incandescent lights for the city of Seoul, and operates over twelve miles of overhead trolley railway. Seoul since the establishment of this plant has assumed quite a metropolitan appearance, and in some respects it is a city more progressive than most of the Asian towns. Altogether, some 1,500 incandescent lamps are used to light it, and half as many more arc lights in the streets. The public buildings and private houses and offices have gradually adopted the electric light, and one sees electricity everywhere in the evening. At first the opposition to railways and electric lights was so pronounced that few natives would patronize them, but conditions have rapidly changed for the better under Japanese influences. Certainly in this respect the Japanese have helped the Americans to open Korea in a most satisfactory way. The machinery and equipments of the railway and lighting apparatus are all of American pattern. There are two double-current generators made by a Pittsburg firm and the boilers are of the water-tube type. High-voltage alternating current is used. A direct current of 550 volts is produced by the generators for operating the railway, and the alternating current is employed for the city lighting. The extension of the plant in the past year has been proposed, and but for the war it would have been nearly doubled in capacity. American and Japanese engineers were drawing plans for extending the railway, and for introducing the electric lighting to the suburbs; but nothing will probably be done now until after the war.

Should Japan defeat Russia and hold Korea, the peninsula empire would become one of the most fertile fields for electrical development in the Far East. At Chemulpo there is a smaller electrical plant for lighting and power purposes, and, as the seaport of the capital of the country, this would prove an important field for introducing American electrical machinery. On the southern coast of Korea, Fusan has one or two American electrical plants, and electric railways running from there to Masampo and Tongi along the coast have been proposed. Masampo is the nearest good port that the Japanese can reach, and every effort will be made to develop it and establish direct connections with the lower end of the proposed steam railroad running from Fusan to Seoul.

Telephones are also largely being used in Korea. In the foreign quarters of Seoul a city telephone system has been inaugurated recently, and the natives are gradually making use of it. The Japanese army of occupation, according to recent reports, are extending the service so as to connect all parts of the army with headquarters. In China telephones have been introduced by the German, French, and English residents, and in Korea the American telephone apparatus is almost exclusively used.

Japan is an excellent market for American electrical machinery and instruments, as shown by consular and other reports. Electrical instruments last year were exported to Japan to the value of $26,781, and electrical machinery sent to the little island empire reached a total valuation of $70,592. These amounts may not seem large, but considering the condition of the country last year, and its gradual opening to the influences of American ideas, the exports of electrical goods showed gratifying encouragement. Boilers and machinery that had more or less direct connection with the electrical trade were exported to Japan from this country to something like $175,000 more, than that of exclusive electrical apparatus. Orders for American electrical goods for the current year had been placed in this country, dependent upon the outbreak of hostilities.

Japan is a field that will show increasing demand in the next decade for American machinery and electrical apparatus. The Japanese engineers and electrical experts educated in this country are opening the way for a steady demand for our products. If the present war should prove favorable to Japan, an unexampled trade demand for American electrical machinery will follow. Electrical railways will be projected in a dozen different centers of the island empire, and with their special predilection for American goods the Japanese will undoubtedly place most of their orders in this country. We have even built up a good trade in automobiles in that distant land, and a number of American electrical automobiles were shipped to Japan just prior to the war. Copper wire for electrical construction work has become a considerable item of export to Japan, and the figures furnished by our consuls indicate that nearly every line of electrical equipment will receive a new impetus when the war ends. Meanwhile, agents of the large electrical companies are watching the development of events, ready with accustomed American vigor to open a trade campaign in Korea and Japan that will mark a new era in our exports to the Far East.

THE POLAR REGIONS.

National emulation, more particularly since the great success of Nansen, seems to have played the chief rôle in all the recent researches undertaken in the vicinity of the poles.

No fewer than three expeditions were organized in 1902 for the main purpose of reaching the North Pole. Otto Sverdrup, the Norwegian, with Nansen's old ship, the "Fram," started in through Smith Sound; Lieut. Robert E. Peary, of the United States navy, pursued a like course; while Mr. E. B. Baldwin, also an American, selected Franz Josef Land as his point of departure, although Prince Luigi, of Savoy, had only just vainly attempted it.

The expedition led by Capt. Sverdrup was incontestably the most successful, says Dr. Herman Haack in his Geographen Kalender. As early as 1898 his expedition was already under way. He spent the first winter north of Cape Sabine, where, by means of extended sledge journeys, he explored the fiords of Hayes Sound, in the following spring even advancing as far as the west coast of Ellesmereland. Finding the ice conditions no more favorable in 1899 than in the previous summer, he abandoned forthwith his former plan and fixed upon Jones Sound as the starting point for his investigations, in the hope of finding on the west coast of Ellesmereland a better and freer water course to the north than the narrow neck of Smith Sound can afford, which is so easily obstructed by the pack ice from the Pole. Sverdrup met with difficulties also in Jones Sound, for he could push no farther forward than Inglefeld had reached in 1852, and so he took up his second winter quarters at the point where the coast of Ellesmereland seemed to bend northward, under north latitude 76 deg. 29 min. and west longitude 84 deg. 24 min.

The sledge journeys of the fall of that year established the fact that Ellesmereland extended much farther westward than was supposed, and was separated from North Kent only by the Belcher Channel, a small arm of the sea. In the spring of 1900 Sverdrup continued the exploration of the west coast of Ellesmereland, where he discovered a deep fiord, while his assistant, Isachsen, examined a large body of land lying to the west of it. The "Fram" being free from ice in August, the passage through Jones Sound was continued, but the ship was soon fast again in the Belcher Channel near the westernmost point of Ellesmereland, and Sverdrup established his third winter quarters under latitude 76 deg. 48 min. and longitude 89 deg. The fall of 1900 and the spring of 1901 were devoted to sledge journeys.

Sverdrup himself continued his exploration of Ellesmereland, examining anew and more thoroughly the fiord which he discovered the year before, after which he turned northward and succeeded in reaching the most westerly point occupied by him in the spring of 1899 to which he had then proceeded from Smith Sound.

Isachsen proceeded westward and discovered north of North Cornwall two larger islands, exploring their southern coasts till they turned toward the north. Under latitude 79 deg. 30 min. and longitude 106 deg., he reached his farthest western limit, from which point neither to the west nor to the north was any land visible, and from the character of the floating ice it was not probable that any land existed in either direction. In July of that year the north coast of North Devon was explored in boats.

All attempts to get the "Fram" out of the ice having failed, Sverdrup was compelled to pass a fourth winter in 1901-2 in this region, during which other extended sledge journeys were undertaken. Following the west coast of Ellesmereland, Sverdrup attempted to reach 80 deg. 16 min. N., 85 deg. 33 min. W., the

farthest point attained by Lieut. Aldrich, of the English Polar Expedition of 1875-76 on the west coast of Grinnell Land coming down from the north. He was not successful, however, though he penetrated as far north as 80 deg. 37 min., which was but a short distance from the goal. Sledge journeys undertaken by other participants in the expedition resulted in the exploration of the west coast of North Devon. In the beginning of August, 1902, when the "Fram" was again free from ice, Sverdrup started immediately upon his homeward way, reaching Stavanger on the 19th of September. The chief result of this expedition was the discovery of large land areas west of Ellesmereland; and since the discovery of Franz Josef Land no such extension of our knowledge of these regions has been signalized.

Lieut. Robert N. Peary, U. S. N., conceived a plan of reaching the North Pole by sledge journeys, accompanied by no one but Esquimaux and his black servant Henson. For this purpose it became necessary to establish, well to the south, a point of departure that could be reached every year by a ship, which should supply fresh provisions and new outfittings, that were to be pushed toward the north and deposited in caches along the coast. The weak point of the scheme lay in the fact that the advance to the farthest points already reached required so much time for so small a sledge crew, that further penetration into the unknown must be undertaken at an advanced season of the year, when the stability of the ice made such a movement questionable. The winter of 1898-99 Peary passed at Etah on the eastern shore of Smith Sound, in order to interest the aborigines in his plan, buy dogs, and perfect other preparations. After his ship, the "Windward," reached him with fresh supplies in the fall of 1899, he was transported to Cape Sabine, which he had fixed upon as the starting point and base of the expedition. Here he passed the winter of 1899-1900. In the spring of 1900 he undertook a sledge journey straight across Ellesmereland, and in the fall of that year established a line of depots toward the north. In the spring of 1901 he made the first energetic move toward the Pole, which led him from Grant Land in the direction of Greenland. He passed the most northern point, 83 deg. 24 min., reached by Lockwood in the Greely expedition of 1882, and fixed, under latitude 83 deg. 39 min., the northern extremity of Greenland. He followed the coast toward the east until it began to bend decidedly to the southeast in the direction of Independence Bay, thus establishing the insular nature of Greenland.

On his return he made a dash for the north and reached 83 deg. 50 min., the highest point thus far attained on the American side of the polar archipelago. During the spring of 1902, Peary even exceeded this. Starting from Cape Hekla, the northernmost point of Grant Land, he proceeded over the ice as far as 84 deg. 17 min., while Capt. Markham in 1876 succeeded only in reaching 83 deg. 20 min. from this side. From the European side, however, Capt. Cagni, of the Italian expedition, starting from Franz Josef Land, attained the advanced position of 86 deg. 34 min. Peary was obliged to make his dash in April, and, as was the case with Markham, he found the ice in a very unsatisfactory condition; the immense hummocks of compressed drift-ice increased the difficulties of travel for both dogs and men. There were no traces, however, of the unchangeable paleocrystic ice mentioned by Markham, for on the return Peary met with numerous open places and channels which caused serious delays. No land was visible to the north of either Greenland or Grant Land. In spite of the unsuccessful termination of his expedition, Peary is still convinced that the best point of departure is from the American side of the archipelago, and, moreover, that, with an early start from Grant Land, the Pole may be reached by sledge. Though Sverdrup and Peary added to our knowledge of the Polar regions, the third expedition fitted out by Mr. Ziegler, an American, and under the direction of Mr. Baldwin, who started from Franz Josef Land for the Pole, was closed without definite results. Several small islands were discovered; the hut in which Nansen and Johansen lived in 1895-6 was again found; some scientific events were noted; meteorological sketches and photographs of the Northern Lights were made; and yet the finality of the expedition was a fiasco. No earnest attempt to reach the Pole was made. Serious friction between Baldwin and Fridtjof, the sailing master of the expedition, is responsible for the unsuccessful termination.

Among the most important of the Polar expeditions is that led by Baron Toll, a Russian, for the discovery and exploration of the island either existing or supposed to exist to the north of the New Siberian Islands. Having twice before, in 1886 and 1894, visited the northernmost of these islands, Toll left Europe again in 1900 in the steamship "Sarja" upon a similar quest. Upon entering the Sea of Kara, he did not pick up the ship which was bringing him coal, and since both the condition of the ice and the open sea were favorable to his designs, he preferred not to wait for it. Cape Tscheljuskin, the extreme northern point of Asia, and the intended termination of the first summer's journey, was not reached, but the condition of the ice compelled him to put into Colin-Archer haven at the entrance to the Taimyr Straits on September 26, where he passed the winter.

Failing in two attempts to gain the mouth of the Jenissei by crossing the land, Lieut. Kolomeixoff finally reached it by following the coast. During the spring of 1901, the extent of Taimyr Bay was carefully explored upon sleds, and through the discovery of the hut in which Lapten spent the winter of 1840-1, as well as by reaching the most northern station of the Middendorf expedition of 1843, the mouth of the Taimyr River was definitely fixed. The "Sarja" could not proceed till August 25. Cape Tscheljuskin was safely rounded and the course set for the location where, according to Toll's observation in 1886, the distant Polarland, seen as early as 1811 by Sannikow, to the north of Kotelny, ought to be. This point was passed without sighting the supposed land, and a few miles before reaching Cape Emma, the southernmost point on Bennett Island, discovered by the "Jeannette" expedition, the ice became so packed that further progress northward was impossible. On the return voyage the ship cruised again in the vicinity of the supposed Sannikow land, but without sighting it. On September 24, 1901, the "Sarja" froze in at the island of Kotelny in Nerpitscha Bay, where the expedition passed the winter. Whether or not Sannikow and Toll were deceived as to what they saw cannot yet be determined. It is quite possible that they may have miscalculated the distance and that the island may lie farther north in a section not touched even by Nansen's drift in the "Fram" during the long winter night of 1893-4.

Unable to get coal from the Lena River, the "Sarja" became unfit for long journeys; accordingly Toll resolved upon sledge journeys to the north, similar to those undertaken from the "Fram" by Nansen. The geologist Birula began such a journey May 11, intending to explore the largest of the New Siberian Islands. On June 5 Toll followed him, accompanied by the astronomer Seeberg and two Jakuts, but touched only at the northernmost point, Cape Wyssoki, which he left on July 13, crossing the ice for Bennett Island. Toll left Lieut. F. Mattheissen in charge of the "Sarja," but August 21 arrived before any earnest effort could be made to proceed to New Siberia and Bennett Land to bring back the sledge parties. About Kotelny and Faddejew the ice was so thick that these islands could be passed neither to the north nor the south; and since the open season was fast drawing to a close, Mattheissen brought the "Sarja" back to the Lena, where he anchored in the bay of Tiksi September 8. Being too deep of draft to steam up the river, the "Sarja" was abandoned, and the crew, together with the scientific collection and instruments, were transferred to Jakutsk on the small steamer "Lena."

It was expected that Toll and Birula would return to the mainland at the beginning of winter, but Birula returned in 1903, in good health, without having seen Toll. Perhaps the condition of the ice between Bennett Land and New Siberia prevented Toll's return, and it was held that he would attempt it again in the spring of 1903.

CALCIUM CARBIDE AND ITS COMMERCIAL DEVELOPMENT.

The wonderful simplicity of the reaction of water on calcium carbide to produce acetylene gas has doubtless struck almost every student who has had occasion to generate the gas. The important effect which Willson's discovery of electrically producing calcium carbide in commercial quantities will have upon the gas industry of the civilized world, an effect which is due in part at least to this very simplicity of producing the gas, may well be shown by tracing the development of the carbide and acetylene industries in Germany.

There are about eight thousand acetylene installations, of all capacities, in active operation at the present time in that country.

Acetylene is coming into use for driving gas engines; 5.65 cubic feet develop 1 horse-power, for the development of which 21.19 cubic feet of coal-gas are required. The small weight of carbide needed for the production of a given illumination gives acetylene an advantage over other illuminants for colonial and military uses, where the cost of transport forms an important item. The high temperature of 2,700 degrees of the acetylene Bunsen flame renders it valuable for soldering purposes. For miners' and other portable lamps a portable acetylene generator is now largely used. Acetylene is also adopted in factories and other places where colors have to be distinguished and compared by artificial light. Investigations on the Elbe have shown that acetylene is very suitable for lighthouse illumination and for signaling at sea. Carbide containing a high percentage of phosphorus is useful for destroying parasites on vines.

SCIENCE NOTES.

The symbol of the two-headed eagle is considered by some heralds to be merely the result of the heraldic practice of "dimidiation," which crept into English heraldry during the reign of Edward I. Dimidiation was simply a child's way of impaling two coats-of-arms on the same shield by the primitive method of cutting each in half and taking the dexter half of one and the sinister half of the other and placing them back to back, as it were. Strange two-headed beasts naturally resulted, as, for instance, when a lion and an eagle were halved and joined together, and the griffin is supposed to have been evolved from two lions rampant by dimidiation. It robs the two-headed eagle of half its terrors to know that it owes its origin to this sort of child's play. The gryphon and mock turtle that went out to sea with the whiting are far more serious creations.

Dr. Jules Rehns, of Paris, has been carrying out several experiments to ascertain the precise effects of radium burning upon the skin. If the rays of one-sixteen-hundredth part of an ounce of radium bromide are applied no pain is experienced, nor is there any mark left at the time of application, but twenty-four hours later a red mark appears, remains for a fortnight, fades, and leaves behind a scar similar to that of a burn. If the application be continued for ten minutes instead of five, the mark becomes visible in eighteen hours. Ulceration does not occur unless the radium has been applied for at least an hour. If the spot thus caused is treated medically, suppuration may be prevented and the wound cured in six weeks or two months. But if it is not attended to, it gathers, becomes painful, and lasts an indefinite period. Some of these wounds or burns, caused three months ago by one hour's application of radium, still show no signs of healing. Moles can be destroyed by applying the radium for ten minutes.

Glass is known to be blackened under the influence of radium rays, the same phenomenon being observed in the case of quartz. The coloration produced by radium will disappear, not only under the influence of heat, but at ordinary temperatures as well. N. Georgiewski, in a paper recently presented to the Russian Physico-Chemical Society, has investigated by a photometric method the absorption of glasses and of quartz colored by radium rays, as well as its diminution in coloration with time, this diminution being represented by a logarithmic curve. The author describes his experiments made on quartz, mica, gypsum, and other bodies, showing the alteration of the optical properties of these materials, as occurring under the influence of radium rays. Mica, being placed between crossed Nicol prisms, shows an alteration in the chromatic polarization in the portion which formerly was exposed to the action of radium rays, this alteration disappearing as soon as the specimen is heated. Gypsum and fluorspar, while showing the same alterations of the optical properties, are not blackened under the influence of radium rays.

In order to show the diffusion of the emanation from radium bromide, a long tube was used, the internal surface of which was coated with a layer of sidobiende (zinc sulphide). On connecting the apparatus with a test tube containing a solution of radium bromide, a luminescence was found to appear and to be propagated throughout the tube. On repeating Ramsay's experiments, Th. Indricson (see paper read before the Russian Physico-Chem. Society) found the yellow helium line not to coincide with the yellow line of the spectrum given by the emanation, but to lie between the two yellow lines of the emanation. If the coil of pipe communicating with the tube was dipped into liquefied air, a strengthening of the lines corresponding to the helium line was noted in the spectrum of the emanation; while between the two yellow lines above referred to, a third line coinciding with the yellow line of helium would appear. The lines of helium do not exist in the spectrum given by the emanation of a freshly-prepared tube, but appear only afterward. On observing the gases set free on the dissolution of radium bromide, it was observed that the helium lines did not appear as long as the spectrum tube preserved its phosphorescence in the dark. After four days, this phosphorescence would disappear, while the lines of helium were noted in the spectrum.

A pipe line 280 miles long, built for the purpose of conveying oil from the Kern River district to a shipping point on San Francisco Bay, was recently completed and opened for service, when a very unexpected difficulty was encountered. The oil is so heavy that it moved through the pipe at a sluggish rate of speed, which makes this method of transporting the oil impracticable unless some improvement in the process can be devised. The oil was five days traveling the first thirty-seven miles, when it was decided to abandon the work. It has been decided to make the experiment of heating the oil to a point of about 120 degrees, and at the same time the number of pumping stations will be greatly increased.

THE FIRST AMERICAN AUTO-BOAT CONTEST.

Auto-boat racing made its first bid for public favor on Decoration Day. The event was held under the auspices of the Manhasset Bay Yacht Club, of Port Washington, L. I. Of the strictly auto class there were four starters, and in addition there were eight other power boats of different sizes and speeds. While the number of competitors fell below expectations, the result demonstrated the fact that auto-boat racing is destined to hereafter occupy an important place in the list of national sports.

The four auto-boats were divided into two classes. In class R, for boats from 70 to 80 feet, the only entry was the "Japansky," a handsome white boat of 40.99 horse-power and a racing rating of 70.65 feet. Her waterline measurement was 38 feet, 11 inches. The Gas Engine and Power Company and Seabury & Co., of Morris Heights, N. Y., are responsible for both hull and engine. Her owner is F. H. Waldorf.

for a contest. Unfortunately, the "Standard" had one of her screws disabled, and the Vanderbilt entry damaged her rudder while making a quick turn to avoid a collision. In the race itself the "Shooting Star" did not finish.

The "Miss Swift," the only entry in Class H, for open boats, did good work. Fitted with a Buffalo engine of 26.09 horse-power, she covered the course in 1:29:57. A peculiar feature of "Fiat No. 2" was the gun-like conning tower, shown in the illustration accompanying this article. The helmsman looking through the long tube steers his boat, while at the same time he is protected from the spray thrown up by the sharp bow.

Outside of the strictly auto class there was a fair showing. The "Allure," fitted with a Craig engine of 58.90 horse-power; the "Ardis," with a Buffalo engine of 10.81 horse-power; the "Flash," with a Buffalo engine of 16.22 horse-power; the "Javelin," with a Stand-

CLASS S.

Start, 2.40 P. M. Course, 19½ knots.

Boat and Owner.	Rating.	Finish. H. M. S.	Elapsed Time. H. M. S.
"Fiat No. 2," C. H. Tangerman..	65.05	3 53 23	1 13 23
"Shooting Star," H. A. Lozier...	62.06	Did not finish.	
"Panhard," A. Massanet	54.52	4 02 49	1 22 49
"Panhard's" corrected time.....			1 16 43

CLASS A.

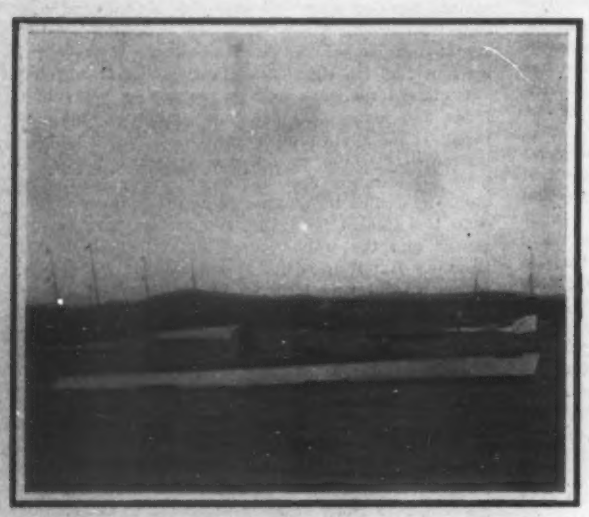
Start, 2.50 P. M. Course, 19½ knots.

Boat and Owner.	Rating.	Finish. H. M. S.	Elapsed Time. H. M. S.
"Allure," Alexander Stein	50.97	4 32 06	1 42 06

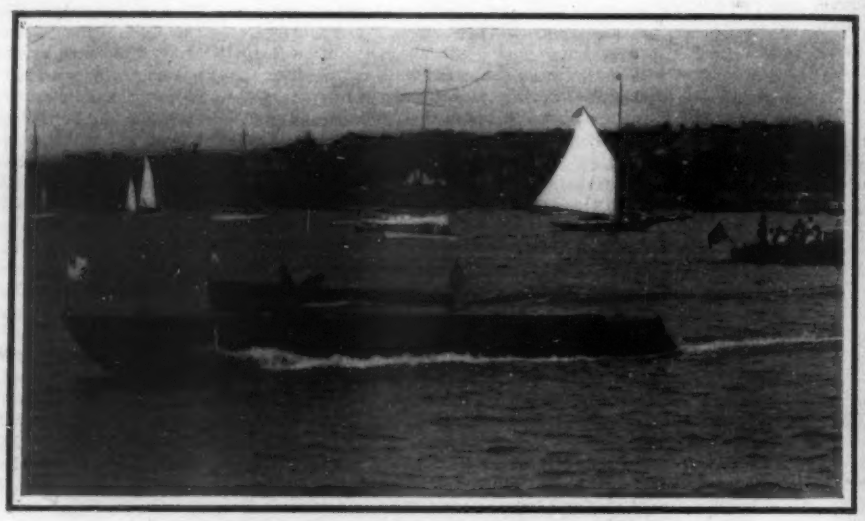
CLASS H.

Start, 2.50 P. M. Course, 19½ knots.

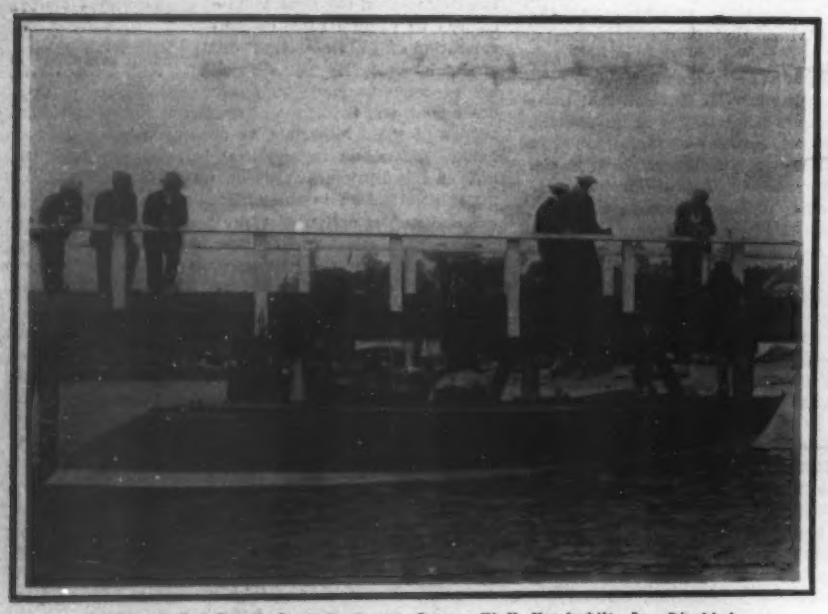
Boat and Owner.	Rating.	Finish. H. M. S.	Elapsed Time. H. M. S.
"Miss Swift," Robert Jacob.. ..	56.07	4 19 57	1 29 57



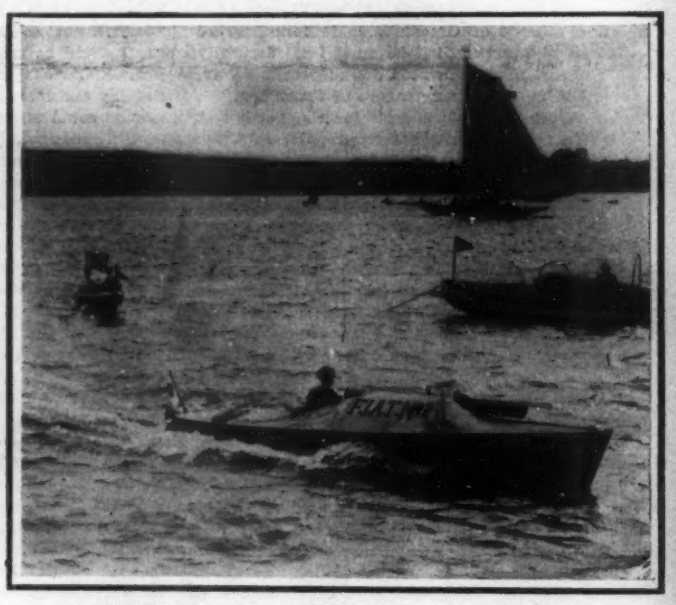
"Japansky"; Owner, F. H. Waldorf; Winner in Class R.



"Miss Swift"; Owner, Robert Jacob; Winner in Class H.



"Hard-Boiled Egg" (Can't Be Beat); Owner, W. K. Vanderbilt, Jr.; Disabled.



"Fiat No. 2"; Owner, C. H. Tangerman; Winner in Class S.

THE FIRST AMERICAN AUTO-BOAT CONTEST.

This boat easily carried off the honors of the day, traveling over a course of 19½ knots in 1 hour, 6 min., and 29 sec., or at the rate of 17.6 knots or 20.3 miles per hour.

The next class, for boats over 60 and not over 70 feet, had two starters, the "Fiat No. 2," C. H. Tangerman owner, with a Fiat engine of 35.17 horse-power, racing rating of 65.05 feet, and waterline length of 22.83 feet; and the "Shooting Star," H. A. Lozier owner, fitted with a Lozier engine of 24.30 horse-power and 62.06 rating. The Panhard boat, although in a lower class, was moved up to compete with the first two. The latter's dimensions were: engine 18.71 horse-power, rating 54.52 feet. A. Massanet is the Panhard's owner. Two other auto-boats that were on hand but did not start were the "Standard," of 86.5 rating, and W. K. Vanderbilt, Jr.'s "Hard-Boiled Egg," of 69.15 rating. The motive power of the latter is a Mors engine taken from one of Mr. Vanderbilt's cars. Both the "Standard" and "Hard-Boiled Egg," in short dashes before the racing began, showed remarkable speed and ability, and gave promise of exciting sport when keyed up

ard engine of 16.36 horse-power, and the "Queen Bess," with a Standard of 27.14 horse-power, started over the full course. A shorter course of 9½ knots was covered by the "Nada," with a Giant engine of 3.03 horse-power, and the "999," with a Strilling engine of 4.26 horse-power.

To those who had not seen auto-boats perform, a surprising feature was the facility with which they were handled. The boats were easily controlled, being started and stopped quickly and turning readily in a comparatively small space. To the uninitiated, the way in which these craft were sent dashing around the crowded harbor seemed the height of recklessness, and reminded one strongly of automobile race meets. While the day passed off without serious accident, it is apparent that in future races a stricter enforcement of reasonable rules must be insisted upon. The following tables will be of interest:

CLASS R.

Start, 2.40 P. M. Course, 19½ knots.

Boat and Owner.	Rating.	Finish. H. M. S.	Elapsed Time. H. M. S.
"Japansky," F. H. Waldorf.....	70.65	3 46 29	1 06 29

CLASS I.

Start, 2.50 P. M. Course, 19½ knots.

Boat and Owner.	Rating.	Finish. H. M. S.	Elapsed Time. H. M. S.
"Ardis," R. M. Haddock	45.54	4 41 16	1 51 16
"Flash," Alexander Stein	44.74	4 55 10	2 05 10
"Javelin," C. W. Lee.....	41.50	4 56 35	2 06 35

CLASS C.

Start, 2.55 P. M. Course, 19½ knots.

Boat and Owner.	Rating.	Finish. H. M. S.	Elapsed Time. H. M. S.
"Queen Bess," R. H. Stern.....	34.65	5 11 29	2 16 29

CLASS K.

Start, 2.55 P. M. Course, 9½ knots.

Boat and Owner.	Rating.	Finish. H. M. S.	Elapsed Time. H. M. S.
"Nada," C. A. Godshalk.....	30.15	3 57 35	1 02 35
"999," J. N. Schoonmaker.....	31.05	4 16 02	1 21 02

The winners were "Japansky," "Fiat No. 2," "Allure," and "Miss Swift."

THE BRITISH NAVAL SCHOOL FOR THE TRAINING OF DIVERS.

BY OUR ENGLISH CORRESPONDENT.

Every vessel in the British navy carries a diving section, composed of men expert and skillful in all kinds of submarine work. Such a detachment is absolutely indispensable, in view of the fact that through unforeseen circumstances the submerged portion of the hull of the armorclad, and especially the propellers, often require examination; while in cases of accident, such as collision and running aground, a close investigation to discover any possible injury to the iron sheath of the ship has to be carried out, and occasionally, if the damage is serious, considerable submarine patching has to be done until the vessel can reach drydock.

The diving section of the British navy is comprised throughout of volunteers. No man is compelled to become a member of the detachment, even if physically fit, owing to the peculiarly hazardous and arduous nature of the work. As an inducement, however, the Admiralty pay the divers a higher salary, as well as offering the men other special privileges.

When a man volunteers for diving service, he is at first submitted to a rigorous medical examination. Owing to the enormous pressures to which the body is subjected at different depths, only those with the strongest constitutions and in perfect health are admitted. No man is passed who has a short neck, is full blooded, or has a florid complexion; nor those suffering from head and heart complaints, or from a sluggish circulation of the blood. The medical qualifications are very strict, as indeed they should be, as a weakened constitution would expose the man to extremely dangerous risks under water. Furthermore, when a man passes beneath the water's surface, any physical defects he may possess immediately show themselves in an accentuated manner.

The medical conditions satisfied, the man is drafted to one of the three diving schools. These are at Portsmouth, Devonport, and Chatham respectively, but the largest and most important is at the premier dockyard of Portsmouth. Here the man is initiated into submarine work, special classes for this purpose being held. As the first and greatest difficulty which the man has to surmount is nervousness, the training is not carried out in the open sea, but in a large circular steel tank built on the shore. This tank measures about 13 feet in height by approximately 18 feet in diameter, and is pierced with a number of glazed portholes, through which the instructor can follow and watch his pupils' movements. A gallery extends around the top of this tank a short distance, from which the diver makes his descents into, and ascents from, the water within.

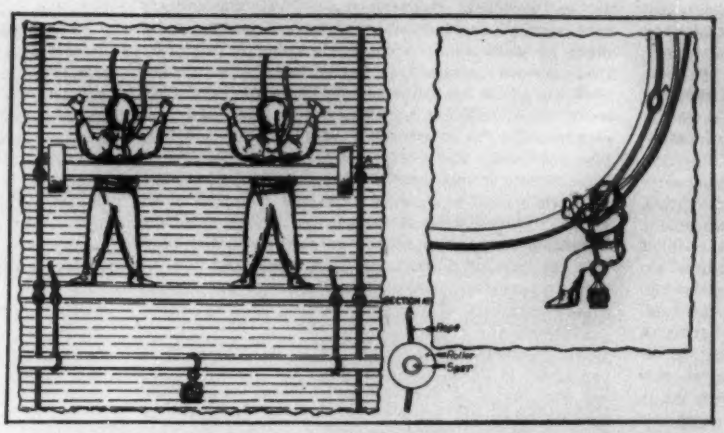
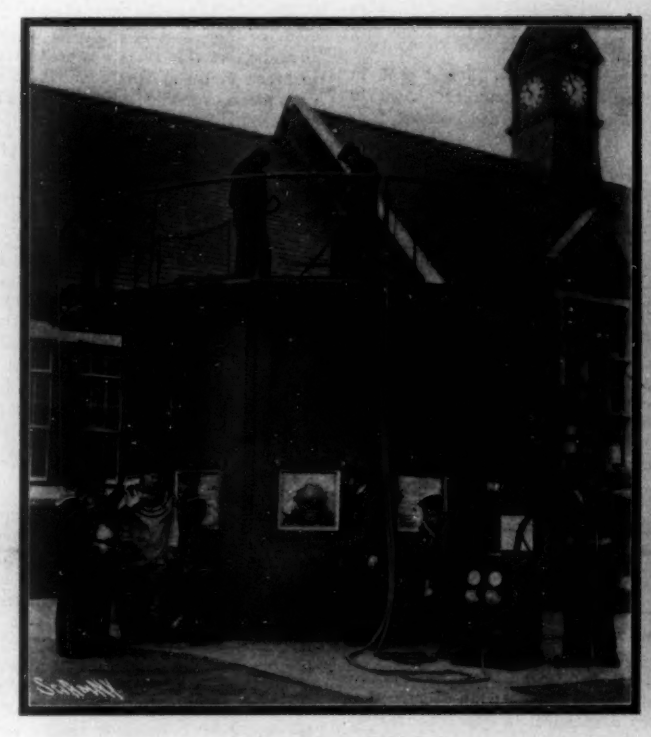


Diagram Showing How Divers Work on the Staging in Order to Clean the Bottoms of Warships.

The man is first instructed in the nature of his dress and equipment, and how to employ the appurtenances with which he is provided, such as the telephone, lifeline, and ladder. Owing to the clumsy and weighty nature of the diving dress, the sailor experiences considerable difficulty in becoming accustomed to it. He is then instructed as to the manner in which he must descend and ascend the ladder, and how to utilize the outfit and tools with which he is supplied. The first named is a most important point.

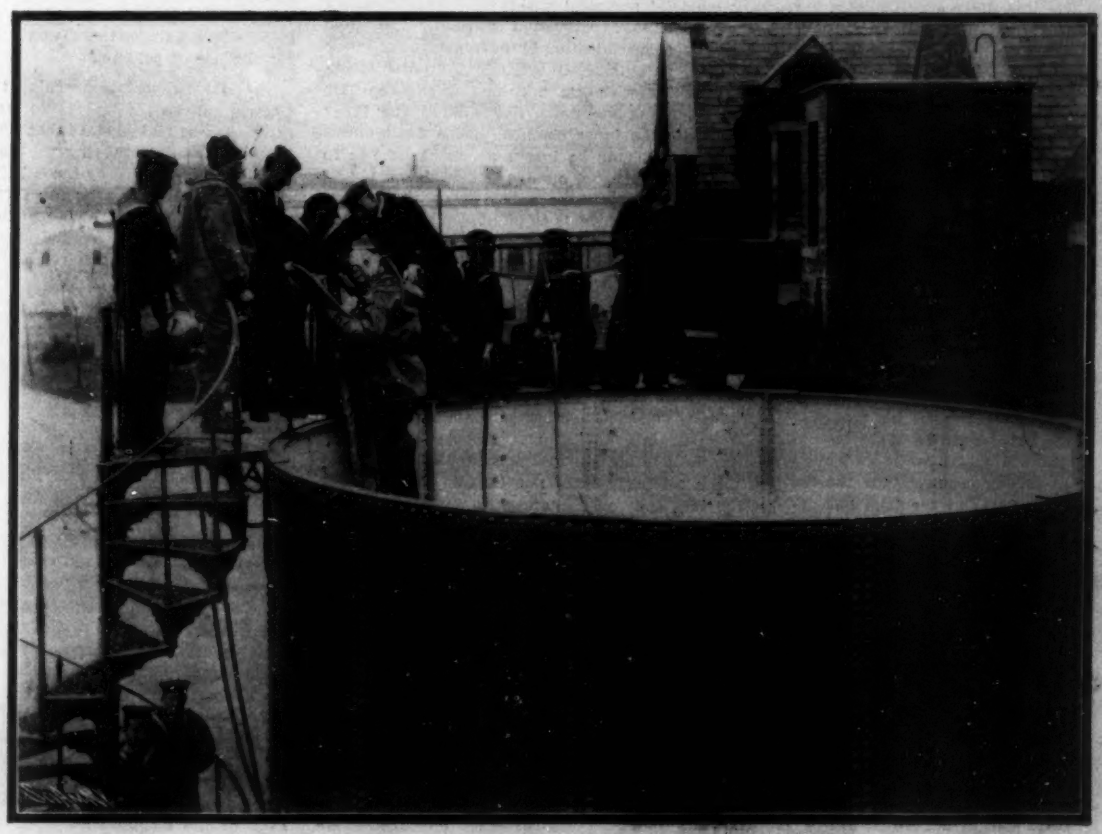
Directly the diver disappears beneath the surface of the water, his body becomes subjected to a heavier pressure. For instance, at a depth of 20 feet the pressure is 8½ pounds to the square inch above atmospheric. It increases proportionately as he descends lower and lower until at, say, 204 feet, which is the greatest depth to which a diver has penetrated — this depth was reached by the diver James Hooper, when in quest of the "Cape Horn," sunk off Pichidanque, South America—the enormous pressure of 88½ pounds to the square inch has to be sustained. Even at the moderate depth of 32 feet the man's body has to support an aggregate pressure of 20,000 pounds weight, besides the ordinary normal air pressure, which represents another 20,000 pounds, making a total pressure of 40,000 pounds.

When a diver makes his initial descent, owing to the strangeness of the experience, he suffers from a curious pulsation and gasping for breath. These peculiarities will not be overcome until the man has regained his confidence.



The Diving Tank at Whale Island, Where Sailors Are Taught How to Dive.

The Sailor's First Lesson in Diving. He Rises on His Back.



The Pupil Receiving His Last Instructions Before Descending Into the Tank.

THE BRITISH NAVAL SCHOOL FOR THE TRAINING OF DIVERS.

Should a man betray evidences of more than usual nervousness after his first descent into the water, he is expelled from the class; for although the Admiralty do not compel a man to become a diver, they insist that he should immediately overcome any inherent timidity. The instructor accompanies the man to the gallery of the tank, conveys to him his commands, especially insisting upon slow ascent and descent. The diver then enters the water, and the instructor follows his movements through the glazed portholes, transmits his instructions through the telephonic apparatus, and inculcates the man into the code of signals generally employed. At first the sailor experiences considerable difficulty in moving about the bottom of the tank in his 40-pound shoes—the total weight of a diver's dress is 160 pounds—but in a short time he becomes accustomed to the task.

The diver undergoes six weeks' training at this curious school. At the conclusion of this term he is attached to the open-sea class, and has to carry out his work under natural conditions.

As the instructor cannot now watch the diver's movements, the pupil has to rely upon his own confidence. Diving in a tank in a limited water space he soon finds to be vastly different from diving in the open sea, where he has to encounter currents and tides.

Before he makes his descent, the instructor impresses again upon the diver the urgent necessity of careful descent and ascent, and what to do if he desires to come to the surface suddenly, or emergency necessitates a rapid ascent. These instructions are most vital, especially in descending and ascending carefully. At times he must cease in his descent to recover his equilibrium, and if he experiences any pain in his head, he must ascend a few feet until the pain has passed away, and then resume his descent even more slowly than before.

A slow ascent is even more essential than a slow descent, especially if the man is at all full blooded. As the pressure upon the body decreases, there is a tendency in this case for the blood rush to the head, and serious results may be incurred unless extreme care is taken. A man of strong constitution is not advised to ascend at a greater speed than two feet a second when the depth does not exceed 80 feet. At a greater depth slower speed is even more imperative, for as the man passes to decreased pressures, he must allow the muscles and tissues of his body to be relieved gradually of the enormous pressure they have sustained.

The pupil is at first only taken to a shallow depth, but this is gradually increased as he becomes proficient, until a maximum depth of 120 feet is attained. Beyond this depth naval divers are not compelled to go, but in nearly every instance they do descend to the normal limit of 150 feet. Beyond this latter depth it is not advisable for a man to descend, unless possessed of an abnormally good constitution. The pressure at this depth is enormous, being no less than 65¼ pounds of water to the square inch of the body. Even at the naval limit of 120 feet, the diver experiences a heavy pressure upon his chest and legs, and is supplied with a wickerwork crinoline to wear over his chest, to relieve the pressure upon his lungs.

The pupil is allowed to work under water for only a short time, without coming to the surface for a rest. The emergency ascent constitutes an important part of the diver's curriculum. To accomplish this double-quick rise, the diver has to inflate his diving dress. This is done by closing the regulating valve in his helmet. The result is that the man is impelled to the water's surface like a rocket. Very often the pupil makes this impromptu ascent unintentionally by operating the valve, and he floats in an undignified manner, like an immense India-rubber ball.

When the diver has become accustomed to walking upon the rugged sea bottom, avoiding holes and projections, and is familiarized with the action of currents and tides, he is handed the various tools which he will ultimately have to use. Once more his troubles begin. Considerable practice has to be made before the diver can handle these properly while under water. There is a constant strong tendency for the tool to rise upward, and it is not until the man has handled them for some time that he can manipulate them with any measure of dexterity.

As soon as his diving education is complete and he has become proficient in the work, the diver is at once drafted to form a unit of one of the warship diving detachments. He receives a slightly increased pay for his qualification. When engaged in the actual diving work, however, he receives from $1 to $1.50 per hour, according to the nature of his task and the depth at which he is working.

The naval diver has to fulfill a wide variety of operations. He is in every respect an emergency man, and must be ready at any requisite moment. His principal duties consist of cleaning the warship's bottom, inspecting the underwater fittings, propellers, etc., investigating and temporarily repairing any damage that may be inflicted upon the hull of the vessel in an accident, recovering any valuable article that may be accidentally dropped overboard, if the depth of water is not excessive, recovering torpedoes that may have gone astray during target practice, and such work. On board the vessel the divers are allotted a station at collision quarters, ready to fix the collision mats if the exigencies demand. When the British armorclad "Victoria" sank in the Mediterranean, after being rammed by the "Camperdown," the divers were immediately at their positions with the mats, which unfortunately in this case proved abortive. Then again, if a fire breaks out on board, the diver acts the part of fireman, as he is able, with his helmet, to penetrate smoke that would suffocate the ordinary members of the fire crew.

Cleaning the bottom of the ship is, however, the most common of his duties, as it is imperative, if the vessel is to maintain her high speed average, that her hull should be kept cleared of barnacles and other similar submarine growths that impede her traveling. This work is somewhat tedious. A practised and skillful man can work at it from four to seven hours a day in two shifts, morning and afternoon, and can clean from 63 to 135 square feet per hour, the work accomplished naturally varying with the condition of the bottom of the ship. For this task the Admiralty have designed a special staging.

Three spars measuring from 20 to 25 feet each in length are slung together in the manner shown in the diagram. Two of these spars are secured four feet apart to two bottom lines, and the third spar is slung by two rope tails to the lower spar on the bottom lines, and weighted with a slung shot, so as to hang vertically from three to four feet below it. When working upon the vertical portion of the bottom of the ship, the diver stands on the lower bottom line spar, and is supported in the middle of his back by the upper spar. On the latter, inside the bottom lines, two roller chocks, each about 2 feet 6 inches in diameter, are fixed at either end, so that no risk may be incurred of the upper spar becoming jammed or binding against the vessel's side, and thus disturbing the diver's balance. When working upon the lower curved portion of the bottom, the diver sits upon the slung spar, and adjusts his position by the manipulation of the length of the rope tails.

One of the most important functions of the naval diver, especially in time of war, is the laying of the electrically-fired submarine mines across the entrances to docks and harbors. Taken on the whole, however, the diver is generally regarded as an experienced jack of all trades.

A New Type of Furnace.

A United States patent has been granted to Amos H. Mylin and Lewis B. White for a type of furnace that presents certain novel features of construction, and that may be very economical in coal consumption.

The important features of the invention are an outer casing or fuel-receptacle of any suitable shape forming an outer combustion chamber, and a shell of refractory material arranged within the outer chamber and forming an inner combustion chamber. The latter chamber is in communication by openings in its lower portion with the outer chamber, and the outer chamber is provided with an opening at the top for supplying fuel and air down and around the inner chamber, while the inner chamber has a draft outlet the size of which may be increased if the heat is to be delivered and utilized outside of the furnace, and made smaller, merely to conduct away the incombustible gases, if the heat is to be used inside. Except for this shell, the interior of the receptacle is entirely open and without grate or other obstruction, so that it may be filled with coal, entirely surrounding the shell, which should be of refractory material to resist the intense heat. The air passes down from the top opening through the coal from the coldest to the hottest part of the furnace while the gases are being progressively generated, until, when intimately mixed together and gradually raised in temperature, the air and gases are delivered into the inner combustion chamber, where the heat is highest and most of the combustion takes place. This shell is not clogged with coal or ashes, so that the inner chamber is maintained at a high and uniform heat and all the combustible gases are there consumed without waste and with a high efficiency of fuel.

The Wright Airship Again.

The flying machine invented by Orville and Wilbur Wright, which made a successful flight at Kitty Hawk, N. C., last December, had another trial near Dayton, O., on May 26, which the brothers say was successful. Great secrecy was maintained about the test, and but few witnessed it.

The machine after being propelled along a track for the distance of a hundred feet, rose in the air, and flew a short distance, when it dropped. This was due, the inventors say, to a derangement of the gasoline engine that furnishes the power. In the fall the propellers were broken, and the test could not be repeated.

Electrical Notes.

In several towns in Europe, notably at Cologne, a system of synchronizing the clocks from one central timepiece is in operation. The principle of the invention, which has been devised by an inventor of Zürich, although electrical, dispenses with batteries and contacts. A central clock somewhat similar to the obsolete grandfather's type is established, and this is wound up in the usual manner. In this clock is fitted a specially-designed magnetic inductor, comprising an iron core placed within a fixed coil. This core is magnetized and demagnetized. Any number of secondary clocks, as they are termed, may be synchronized from this timepiece. These secondary clocks, however, are not supplied with the works generally fitted, but carry instead a special apparatus connected to the master clock by electric wires. Once a minute the inductor in the central clock is actuated. A momentary current is thereby generated, and this is transmitted to all the secondary clocks instantly and simultaneously. The result of this current is to operate upon the small mechanism in the secondary clocks, thereby advancing their minute hands minute by minute. By this means a uniform time is maintained among all the secondary clocks, irrespective of the distance they may be from the master timepiece. The advantage of this system is that there are no batteries to break down, and no contacts to wear out. In Cologne alone over two hundred clocks are controlled and synchronized in this manner.

News of a somewhat sensational character is announced relative to the cheap production of metallic calcium. Prof. Borchers, of the Electro-metallurgical Institute of Aix-la-Chapelle, states that he has been making a series of experiments with the electric furnace, and now succeeds in obtaining the metal by the electrolysis of chloride of calcium in fusion. The chloride melts at a comparatively low temperature, 800 deg. C., which makes the operation easy, although considerable trouble was experienced at first in obtaining the proper kind of electrode for reducing the chloride. This difficulty has now been overcome, and he now produces the metal at very low cost, only a small fraction of the price which is now quoted. Although the metal cannot be used in manufacture, seeing that it oxidizes quickly, it will be of great service in the different arts, should it be produced cheaply. it will be especially useful in the chemical industry in organic operations, where its reducing properties will allow it to replace sodium, although it is less powerful than the latter. Calcium would be of value in the metallurgy of iron, seeing that it frees iron from phosphorus, sulphur, and oxygen. It has recently been found useful to add a certain quantity of aluminium to iron for this purpose, and although the specimens of iron containing aluminium are preferable to those containing sulphur and phosphorus, they are inferior to pure iron as regards tensile strength and shocks. If, as some metallurgists suppose, a very small quantity of calcium could be used to eliminate the sulphur and phosphorus and bring the iron to a nearly pure state, and if the presence of the calcium in the metal is no disadvantage, there would be a brilliant future for the use of calcium.

The latest reports concerning the new Rome-Naples electric railroad, which is to be used especially for rapid express trains, state that a royal commission has been formed for studying the new route. Instead of the 150 miles covered by the existing railroad, a shorter route will be chosen, as the former takes five hours with the rapid trains owing to the unfavorable profile of the district. The commission propose to run an entirely new double-track road at about four miles from the coast. It will run at nearly level grade and use maximum curves of 2,700 feet. The two terminal depots at Rome and Naples will be built near the center of each city. The railroad will have about fifteen intermediate stations. The estimated cost of the proposed 122 miles of track, including the part within the two cities and the expenses of the preliminary work is about 18 millions. No special system of traction has as yet been adopted by the commission, but it approves the Valtellina or the new Marienfeld-Zossen system, both from a technical and an economical standpoint. It prefers the use of independent motor cars with common control system such as are used extensively in America. A train of 120 tons would be made up of three motor cars. At a speed of 75 miles an hour such a train would require about 1,500 horse-power. Six trains running on the road at once would take a total of 9,000 horse-power. It is proposed to use hydraulic power for running the road, as there are a number of falls in the district. As much as 100,000 horse-power can be obtained, and it is proposed to distribute part of it to the city of Naples by an overhead line. One-quarter of the total could be thus employed. The main sources of hydraulic power are situated at Cisterna and Sessa Aurunca, lying at a few miles from each of the terminal stations. The total cost of the Rome-Naples system is estimated at $22,000,000, in which the electric outfit figures at $3,000,000.

Correspondence.

The "Missouri" Disaster.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of April 23, page 322, column 2, line 52, I note in the description of the "Missouri" disaster, that our navy still uses pure wool or serge cartridge bags. In my opinion this was the cause of the accident.

The English, German, Japanese, and probably other navies use raw silk for a variety of reasons, and among others that it leaves no burning residue. The fragments of it go out of their own accord in an extremely short space of time, which is not the case with serge fragments.

If the United States navy is to win in future battles, it must fire more aimed shots per minute than the enemy, and there should be no danger limit to any rate of speed that can be reached by human hands.

The ignition point of smokeless powder is too high for the heat of the gun (diminished by water cooling) to set it off. The faster you fire, the quicker you get it out of danger of the heat gradually penetrating the mass, and consequent detonation when fired, which would burst the gun. T. W. BARBER,

Commander U. S. Navy, Retired.

14 Rue Cimarosa, Paris, May 6, 1904.

Narrow-Gage Railroads.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with much interest your article in the last issue of your excellent paper on the "Economy of Narrow-Gage Railroads." While I agree with your ideas of the advantages of roads of the standard width, you fail to mention the saving of cost of the narrow tracks in mountainous countries sparsely settled.

About thirty years ago I was obliged to visit Colorado on some mining business, and was surprised with the facility and speed of the Denver and Rio Grande's narrow-gage road through the Rocky Mountains.

We whirled around the short curves so rapidly that it was necessary for me to hold to the seats to maintain an equilibrium; especially through the Grand Cañon of the Arkansas River, which winds around like a snake, with only one short tunnel.

No standard gage road could follow these routes, with their long curves, without a much greater expense for stone cuttings, fills, and tunnels, also lower grades than two hundred and ninety feet to the mile.

The D. & R. G. RR. then used some of the most powerful engines in the United States to pull seven little freight cars over the mountains.

Hannibal, Mo., May 21, 1904. S. E. WORRELL.

Exposition Stamp Issue.

Postage stamps of the special issue to commemorate the Louisiana Purchase of 1803, and known as the Commemorative Series of 1904, have been placed on sale at post offices throughout the country. These stamps are issued because of the St. Louis Exposition, and the series is one that stamp collectors will want to secure. Stamps of the special issue will not be sold after December 1 next, and while on sale will not take the place of the ordinary issues, which will be sold to customers unless the commemorative stamps are especially asked for. The denominations and colors of the new stamps are as follows:

One cent, green; subject, Robert R. Livingston, United States Minister to France, who conducted the negotiations for the Louisiana Purchase.

Two cent, red; Thomas Jefferson, President of the United States at the time of the Louisiana Purchase.

Three cent, purple; James Monroe, special ambassador to France in the matter of the purchase, who, with Livingston, closed the negotiations.

Five cent, blue; William McKinley, who, as President of the United States, approved the acts of Congress officially connecting the government with the St. Louis Exposition.

Ten cent, brown; United States map, showing the territory of the Louisiana Purchase.

There is no special issue of postal cards, wrappers, or envelopes.

Silkworm Culture.

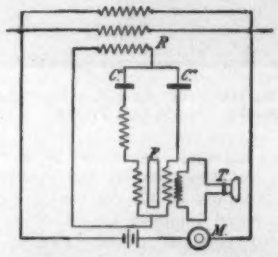
The Department of Agriculture at Washington, D. C., is investigating the possibilities of silkworm culture in the United States. It is hoped that it may in time be developed to such an extent as to prove of benefit to those members of families whose time is not altogether occupied in other ways, and also to other persons in a small way as a side issue. To persons wishing to experiment, and who can furnish proper food for the worms, the department is distributing free of charge a small quantity of silkworm eggs and also a manual of instructions. The proper food for silkworms consists of leaves from the different varieties of white mulberry tree and the Osage orange. The paper mulberry (with the fuzzy leaves) is not suitable, nor is the common red mulberry. As the season is now open, applications for the eggs should be made at once, and must be accompanied by a statement as to the number and kind of mulberry trees or the amount of Osage orange which the applicant possesses; otherwise the eggs will not be sent. If the variety of the mulberry is not known to the applicant, a sample of large leaves should be sent to the department. The Department of Agriculture buys the cocoons which the worms spin, paying for them (after they have been dried) 75 cents to $1 a pound, according to their quality. The work will prove an interesting pastime for women and children who can devote to it odd minutes during the day.

SIMULTANEOUS TELEGRAPHING AND TELEPHONING.

A new system for simultaneous telegraphing and telephoning on the same wire is at present being discussed in the Italian technical press. The system, we learn, has been tested with most satisfactory results on the Rome-Venice telegraph line, but no particulars as to the principles it is based upon had so far been forthcoming. Now, in the May issue of the Elettricista, Prof. A. Banti gives a short description of the apparatus devised by Prof. Brunò and Signor Turchi. The problem the two inventors had to solve may be stated as follows: Two alternate currents of different frequencies traversing one same current, being given, to eliminate the effect of either of them.

In the present case, we have the telephone current and an induced current due to the telegraph current, both exhibiting an alternate character, but each being of different frequency, the effect of the induced current being the one to be annihilated.

In order to show how it is possible to attain this, the author considers a closed circuit, a certain section of which is divided into two branches of equal ohmic resistance, forming a differential coil wound on a weak iron core. Assuming that the two differential branches have different impedances, it will be understood that with a current of given frequency it is possible to regulate the two impedances, so as to have in



CIRCUITS OF THE SYSTEM.

the core a resultant flux equal to zero. If, therefore, two currents of frequencies α_1 and α_2 be passed through the circuit, the latter being, for instance, regulated for the frequency α_1 only the current of frequency α_2 will give a flux different from zero. Now, if the weak iron core be the one of a telephone, the latter will show only the effects of the frequency α_2, and, generally speaking, all those of any other frequency either superior or inferior to α_1. A similar circuit, capable of annihilating the effects on an external circuit of *either* of the currents evolving through it, has been termed *separator* by the inventors.

The separation, as stated above, is obtained for currents of alternate character; in the particular case of either of them being a telegraph current, the frequency of which may range between rather extensive limits, it will be necessary, in order to obtain the separation, that the latter should have a frequency included between the above limits; otherwise the corresponding telegraphic frequencies would be, as well, eliminated.

It may finally be understood, as clearly shown by an analytical discussion of the problem, that the separator will eliminate not only the effects of a current of one single frequency, but those of a certain number of frequencies as well, all of which are very near the *theoretical* frequency, producing a perfect compensation. For frequencies scarcely different from this theoretical frequency the effects on the membrane will, in fact, be very small, on account of the inertia of the latter.

Ordinary telegraphic currents will produce induced currents with frequencies going as far as about 200 periods. Now, as the Brunò-Turchi separator is capable of annihilating the effects of currents having frequencies as high as 200 periods, if in any circuit induced telephonic currents with frequencies of the order above stated and telegraphic currents (the frequencies of which, as is known, are much superior to 200 periods) are present at the same time, the *separator* will annihilate the effects of the former, those of the latter remaining active; in other words, the telegraphic transmission will in no way disturb the telephonic transmission.

The scheme of the arrangement adopted by the inventors is sketched in Fig. 1. One of the three windings forming the coil *R* is inserted in series with the telegraph line, one of the other two windings being used for the insertion of the microphone *M*, the other forming part of the *separator* circuit. This circuit, as stated above, is divided into two branches, including capacities *C'* and *C''* and an inductance, and terminating in two differential windings wound on an iron core *F*, forming at the same time the core of a third winding used for the telephone *T*. A. G.

Automobile Notes.

Baron de Caters, on a 90-horse-power Mercedes car, reduced, on May 15, Rigolly's kilometer record of 23 3-5 to 23 seconds. This is equivalent to a rate of speed of 97¼ miles an hour. The record was made on the Ostend-Nieuport road, and was officially timed.

The long-expected motor water carts beginning to make their appearance in Paris streets are highly successful. This new, useful municipal automobile carries 1,100 gallons. The maximum speed is 18½ miles an hour. Each can be filled in six minutes and can sprinkle a mile of roadway 45 feet wide in 20 minutes. Steam is the motive power, a 35 horse-power engine being used in connection with a bevel gear drive and live rear axle. A connection between the wheels and the water jets regulates automatically the output of the latter, according to the pace of the cart, and closes them altogether when the vehicle stops.

The French and English eliminating trials for the Bennett cup race were run off recently, the French trials in the Circuit des Ardennes and the English on the Isle of Man. The trials consisted mainly of a road race similar to the actual race for the trophy, which takes place in Germany over a course in the vicinity of Homburg on June 17. As a result of the trials, a Richard-Brazier, a Mors, and a Turcat-Méry car were chosen to represent France, and a Napier and two Wolseley cars to represent England. The German team will probably consist of two Mercedes and an Opel-Darracq car, while that sent by Italy will be made up of three Fiat machines. America will not be represented this year owing to some of the machines that were to have been entered in the American trials not being ready and to no proper test being made of the cars that were prepared. The Bennett race this year will be run under the supervision of the German Emperor, and the Germans will do their best to keep the trophy in their country for another year. The fact that two of the French machines and two of the English ones selected are makes of cars which have never before been entered in this now classic race, shows that even the best of manufacturers have a hard time to always show superiority when their machines are selected by competitive trial, as they were this year.

Death of E. J. Marey.

Prof. E. J. Marey is dead. He was well known to the scientific world as an indefatigable investigator, whose work was ever marked by striking originality. His early researches were confined to arterial pulsations, and culminated in the invention of apparatus by which they could be inscribed on a moving surface, so as to give a graphic record from which their time relations might be computed. The sphygmograph was one of these inventions, which first saw light in 1863. Later Marey, in collaboration with Chauveau, took up the study of the heart. This collaboration proved scientifically fruitful. The one man was a skilled mechanician, the other a trained experimenter. The results of their work were communicated to the Parisian Academy of Sciences. Marey's graphic methods were later extended to the study of various forms of locomotion, especially the flight of birds. To him, perhaps, more than any other scientist, is due the development of chronophotographic apparatus, such as the cinematograph and biograph.

The Current Supplement.

The current SUPPLEMENT, No. 1454, opens with an elaborately illustrated article by Mr. Guy E. Mitchell, describing the government irrigation work planned south of Minidoka, near the Snake River. "Experiments Showing the Efficiency of Radiators for Gasoline Automobiles" is the title of an article of considerable technical value to chauffeurs. Dr. Lee De Forest has much that is interesting to say on wireless telegraph transmitters. "Notes on the Herons of the District of Columbia" is the subject of an interesting study of bird life by Mr. Paul Bartsch. A complete list of radio-active minerals and substances thus far discovered is published.

A composition of nine parts lead and one part silver melts at 400 deg. C. Three parts lead and one part silver melts at 500 deg. C. Six parts lead and four parts silver melts at 600 deg. C. Eight parts silver and two parts copper melts at 850 deg. C. These alloys are convenient for temperature determinations.

AN AMERICAN BUDDHIST TEMPLE.

BY HARRY DILLON JONES.

A curious side light to the war is the number of petitions ascending to the God of Battles. While the Russians are holding services in the various churches of their faith, in the Russian quarters of American cities Hebrews are reported to be praying to their Messiah to bring to rout the hosts of the Czar and humble their persecutor as the enemies of the Israelites of old were humbled. But the strangest petitions of all are to be heard in the Buddhist temple at the University of Pennsylvania. Here, in a place of worship for devotees of Buddha set up piece by piece by the late Prof. Sommerville, of the chair of glyptology, who spent the greater part of his life traveling in the Orient in search of curios, the Japanese in this country find themselves in an atmosphere that is so like that of the Land of the Lotus that they easily imagine themselves transported to their island home, worshiping at the familiar shrine of their early days.

The Inner Entrance to the Temple. Showing the Racks on which Hang the Towels all True Buddhists Use During the Cleansing Process that Precedes Worship.

Not a single article necessary to support this idea is missing from the Buddhist temple that Prof. Sommerville has built up. Buddhas of various sizes, but all with the placid face and large head of the god of the Orient, smile benevolently and eternally at the visitors to the temple; lotus plants, symbolical of the life that springs from a lowly beginning to a splendid flowering, give color to the scene around the altar; gods little and big and of various stations in the world of Japanese deities rest on their pedestals within the rail, and smile or threaten according to their mission.

In this curious temple Japanese resident in Philadelphia and chance pilgrims to the Quaker City gather at times during the day to pray for victory for the arms of the Mikado. At the entrance to the temple, or rather at the outer gateway, are the figures of two semi-mendicant fruit sellers, life-size and constructed with the wonderful fidelity to nature for which the Japanese artists are noted. Were they at home the pious Japs would stop to buy from the fruit sellers. As it is they pass the lifelike figures with their pathetic air of emaciated poverty, and walk through the outer gates of the temple to where two gigantic statues stand with great, muscular arms uplifted in an attitude suggestive of dire vengeance should any pilgrim misbehave. These are the Gods of Silence that are found at the entrance to every Buddhist temple. Their threatening attitude is to command intending worshipers to leave all levity behind when they cross the sacred portals of the temple proper.

Past these threatening figures the pilgrim goes to the inner gate of the temple where he is confronted in the softly-lighted passageway by the rack on which are placed the towels used by all true worshipers of Buddha in the cleansing process that precedes the entrance to the house of prayer. From this place of cleansing the pilgrim passes to the temple, in the solemn silence of which he is at liberty to offer his petitions to any of the several gods within the rail. It is no new thing for the attendants at the temple to find Orientals kneeling before the altar. Since the war broke out, however, the visitors who come for prayer and not through curiosity have been steadily increasing in number. The favorite god is a great Buddha that stands on a pedestal outside the railing that surrounds the altar. Some of the gods are magnificent specimens of Oriental carving. This one is just a plain Buddha, the round face and full lips seeming to breathe peacefulness on the surroundings. He is not the kind of god one would picture as a deity of martial characteristics. The serene face is full of gentle benevolence. But the Orientals believe their Buddha can control the destiny of nations, and so they bow before this large-faced god and petition him to so order things that the Japanese banners will wave over the discomfited forces of the Czar and Buddhism triumph over the Greek Church.

Always with the explanation that he was a follower of Christ, although an admirer of many features of the Buddhist religion, Prof. Sommerville lectured frequently at the Buddhist temple. At times he assumed the garb of a Buddhist priest and stood before the altar explaining the services to his audience. At these times it was not unusual for true Buddhists to attend and, far as they were from the Orient, join in a genuine service in which their individual prayers were for the one object that stirs the heart of the Japanese—victory for the Mikado's forces in the East.

Curious Box Trees.

A large number of famous old box trees, trimmed to the shape of animals, birds, and other queer forms, hold a place in the garden surrounding the British building at the World's Fair. The trees are valuable, as it takes many years to cultivate one.

One of the Mendicant Fruit Sellers at the Outer Gate of the Temple.

Prof. Maxwell Sommerville, who Founded the Buddhist Temple at the University of Pennsylvania.

AN AMERICAN BUDDHIST TEMPLE.

COMPLETING THE RAPID TRANSIT SUBWAY.

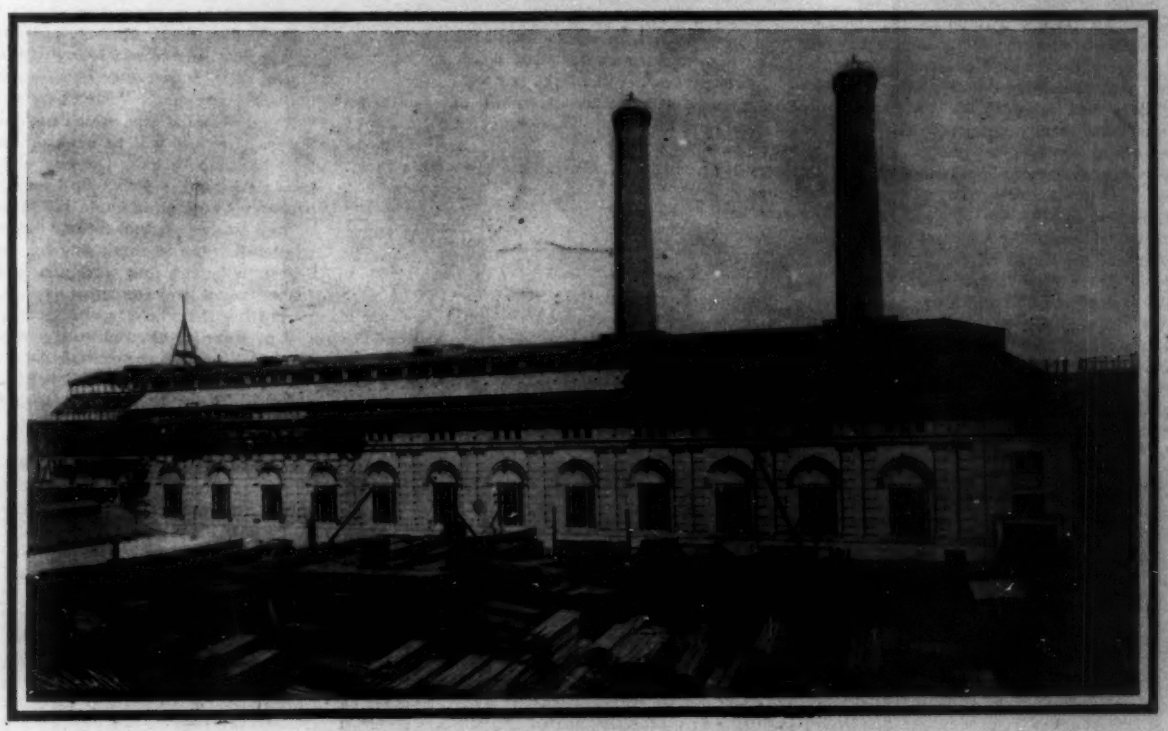
Although the work of finishing the all-but-completed Rapid Transit Subway in this city has seemed, during the last few months, to drag along in wearisome contrast to the dash with which the work was opened and the greater part of it carried through, it is pretty certain that the contractors are doing their best to have the road opened with the least possible delay.

That the promise made a couple of years ago that the road should be open on the first of this year, or nine months before the contract date for completion, has not been fulfilled, is due mainly to the succession of strikes which has occurred to hinder work on one or other section of the road. The most serious strike, as delaying the work, was that which practically shut down all work on the great power station, which is now under construction at the foot of 59th Street and the North River. This strike lasted for many months; and it was long ago seen that its effect would be to put back the opening of the Subway many months beyond the anticipated day of completion. The knowledge that everything would have to wait upon the power house undoubtedly exercised a dampening effect upon the various sub-contractors on the Subway, many of whom would seem to have pulled off their forces and plant for use on other contracts, leaving the work of finishing their Subway contracts to drag slowly along, with infinite discomfort to the citizens of New York.

As far as the contractors for the whole Subway are concerned, the case is entirely different, since there is every inducement for them to get the road in operation and secure some returns upon the vast amount of capital invested, as early as possible. It is certain that work is being rushed upon the power house with as much expedition as is compatible with the necessarily tedious work of building the great electric generators in place; and just as soon as a sufficient amount of the plant is installed for the operation of that part of the Subway which lies in Manhattan Island, the cars will be run into the Subway, the great 12,000-horse-power engines started, and this, the largest and most completely equipped underground system in the world, will be at the service of the citizens of New York.

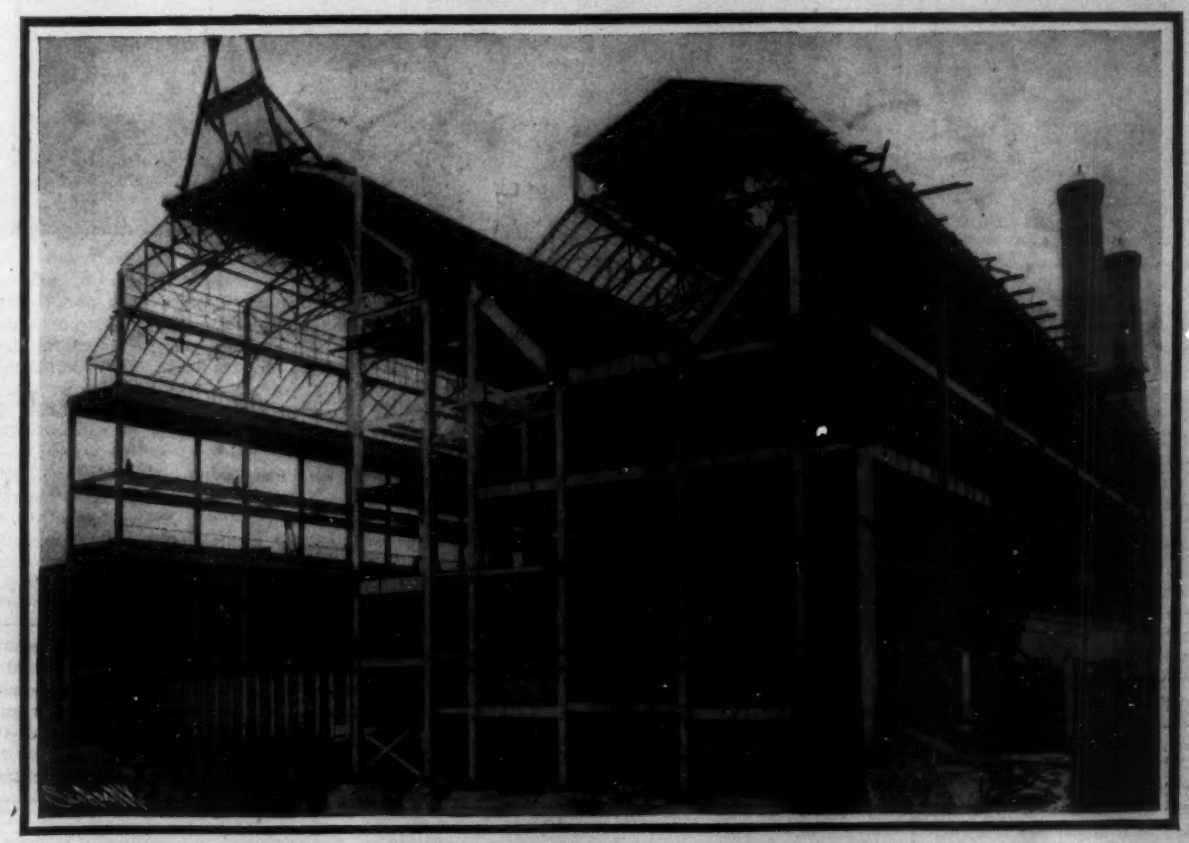
At the present writing it looks probable that the promise of the contractors that the road will be ready for opening on September 1 will be fulfilled. On Manhattan Island the tracks are laid, and practically all of the electric cables, and third rail, and most of the signaling apparatus have been installed, and a majority of the stations are completed, ready for use. The most backward station is the important junction at the Brooklyn Bridge, which, unless a very heavy force is crowded upon it, can hardly be finished by the day tentatively set for opening. There are other stations in the northern part of the city that are also in a backward condition. In some of the stations the work of building the entrance kiosks is not yet completed, and in one or two others the approaches have yet to be built.

We show on our front page two views of one of the most interesting stations on the line, namely, that on the lofty viaduct that carries the Subway tracks across Manhattan Valley. The station is built immediately above 125th Street, over which the viaduct is carried by a very handsome trussed arch of 168½ feet span—by far the most important bridge structure on the whole road. The bridge was designed in the office of the Rapid Transit Commission engineers, and must be regarded as an extremely creditable piece of work, both in its detail and the artistic character of the design. The main arch of three trussed ribs, each of which measures 168½ feet between the end pins and has a depth between the center of chords of 6 feet. A curious feature is that the northern abutment is exactly 5 feet lower than the southern abutment, the difference being due to the difference of grade in the street. Each half of the span is parabolic, the northern half measuring 81.4 feet, and the southern half 87 feet from the end pins to the crown. The chords of each trussed rib are of a general I-section, being built up of four 6-inch by 6-inch by 11-16-inch angles, two 15-inch top and bottom cover plates, and a central web plate. The trussing is on the single intersection system, with vertical posts and diagonal ties. At every other panel vertical posts are erected, which serve to carry the superstructure. The posts are built up of four latticed bulb angles. They are riveted at the top to plate-girder floor beams, upon which run the longitudinal eye-beam stringers for carrying the tracks and the passenger platforms. The main ribs are spaced 24 feet, 3 inches from center to center. The foundations for the bridge had to be made exceptionally heavy, for, on excavating, it was found that they were located on an old bowlder fill. Consequently the excavation was carried down to a depth of 30 feet below ground level, and a monolithic concrete tower was built in the excavation thus formed, beneath the footing of each rib, each of the three foundations being carried back 44½ feet, or sufficiently far to provide a footing for the second transverse bent of the trestle viaduct. The concrete foundations are carried up to the ground level, where massive granite skew-backs serve to take the cast-steel footings of the ribs and the footings of the first trestle



Width, 200 feet. Length, 600 feet. Maximum capacity, 122,000 horse-power.

THE NEW RAPID TRANSIT POWER STATION.

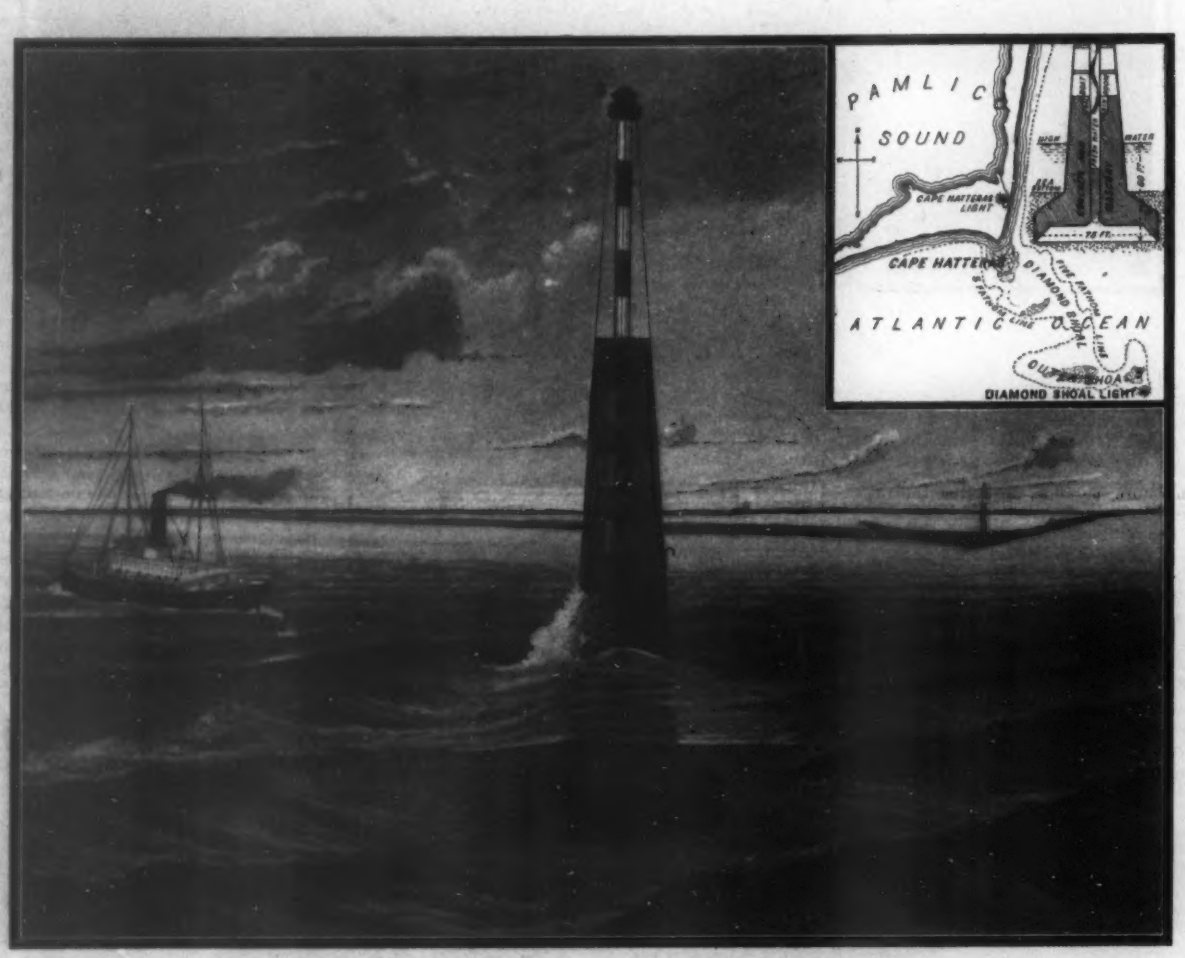


VIEW OF THE POWER STATION FROM THE NORTH RIVER, SHOWING THE ENGINE HOUSE TO THE LEFT AND THE MASSIVE FRAMING OF THE BOILER HOUSE TO THE RIGHT.

bent. The ribs are drawn in at their ends and riveted to a cast-steel, heavily ribbed bearing, which rests, as shown in our front page engraving, upon a turned 8-inch steel pin. The weight of each of the outer ribs is 35 tons, and the inner rib, which carries about double the weight of each outer rib, weighs 60 tons. The total weight of steel in the bridge is 350 tons.

A novel feature in this bridge and its overhead station is that access to the station will be gained by means of a duplex escalator—the first of its kind ever made, which is being built by the Otis Elevator Company. This escalator will run above the ribs until the underside of the floor structure is reached, where it will terminate in platforms, from which stairways will lead to the passenger platforms of the station. The escalator, which will run at greater speed than those with which the New York public is familiar, will carry passengers in both directions.

We present two illustrations of the mammoth power station at 59th Street and the North River. This huge structure, the greatest of its kind in the world, will, when completed, measure 200 feet in width by 690 feet in length. It is divided centrally through its entire length by a wall, which separates the engine room from the boiler room and coal bins. The batteries of water-tube boilers will be carried on several floors, while the uppermost portion of the building below the roof will be occupied by an enormous coal bin, capable of containing 25,000 tons of coal when completely filled. Chutes will lead the coal down directly to the hoppers of the mechanical stokers, from which it will be automatically fed to the furnaces. The ashes will be dumped into the basement, from which they will be conveyed out to be loaded directly into barges on the river front. The coal will be brought in barges to the same dock, whence it will be unloaded by elevators and carried up by automatic conveyors to be dumped into the great coal bin above mentioned. Six lofty smoke-stacks will be arranged at intervals, down the full length of the building, and a novel feature is that the brick portion of the smokestacks will terminate soon after it enters through the roof of the building, the whole substructure of the stacks, consisting of massive steel towers built of riveted columns similar to those that carry the floors of the building. A large amount of interior space will thus be available which has hitherto been taken up by the large bulk of the brick smoke-stacks. Current will be generated by compound engines of 8,000 horse-power. They will be of the same general type and slightly more powerful than those installed in the 76th Street power house of the elevated railway system, and they will have a maximum capacity on overload of over 12,000 horse-power. There will also be installed a separate set of generators for generating current for lighting the Subway, and these will be driven by direct-connected, Westinghouse-Parsons turbines. When completed, this great building will have a maximum capacity of 132,000 horse-power.



THE PROPOSED NEW DIAMOND SHOAL LIGHTHOUSE OFF CAPE HATTERAS.

William Wilcox, a well-known manufacturer of Middletown, Conn., died during the latter part of March. He was the inventor of the rotary key-hub and the flat key which is now in general use. The business over which he presided until a year ago is a very extensive one, and the deceased had amassed a very large fortune in the manufacture of devices and inventions, which were largely the product of his own brain.

PROPOSED LIGHTHOUSE FOR CAPE HATTERAS DIAMOND SHOAL.

The marine graveyard for many ships, steamers and other vessels on the Atlantic coast is generally known to be located around the treacherous Cape Hatteras shoals in North Carolina.

The lighthouse located on the outer bar is too far inward from the Diamond shoals to correctly locate them, while the lightship is too distant seaward to indicate just the line of their outer boundary, but is far enough out to insure sufficient depth for all vessels. In rough weather the light is not easily discernible. A permanent structure located at the edge of the outer shoal, and high enough to be seen in all kinds of weather, has become a necessity. An attempt was made not very long ago to build a lighthouse on this shoal, but was unsuccessful. For four or five years past Capt. Albert F. Eells, of Boston, Mass., has given the subject much study, and has recently been successful in persuading Congress to give him an opportunity to build a lighthouse at his own expense, as explained in the House of Representatives bill No. 7,264. Under the terms of the bill he is authorized to construct a substantial, sufficient lighthouse and fog signal of the most improved construction, together with auxiliary works of the most modern character and such as will be necessary to maintain the same permanently at the outer side of the outer Diamond shoal on the coast of North Carolina, at Cape Hatteras.

Work of construction must begin within a year from last April, and the structure must be begun where the water is at least thirty feet in depth at mean high tide.

The superstructure of the tower, being 30 feet above the high-water line, must conform to the specifications of the government engineers and must have a circular steel tower or mast of sufficient diameter to contain a spiral stairway, all properly braced, the tower to have a light supplied by the lighthouse board which shall be at least 200 feet above mean high tide.

Capt. Eells is given the right to construct the base to a point 30 feet above high water in any modified form and to locate it on the site selected by the lighthouse authorities subject to the approval of the Secretary of the Department of Labor and Commerce.

When the structure is completed Capt. Eells is required to maintain it and the light for one year at his own expense. The Lighthouse Board then operates it for four years at the government expense. If the lighthouse is then approved and accepted by the Secretary of Commerce and Labor, the United States is authorized to pay Capt. Eells the sum of $590,000.

The illustration shows the general shape and proportions of the proposed lighthouse, and the upper diagram sketch explains the sectional construction of the base, with a map showing the location relative to the present lighthouse on the bar. This point is about ten miles seaward therefrom.

The present plan is to construct a steel base about 60 feet high and at the bottom about 75 feet in diameter, with double walls, one inside the other, with a space between varying from 15 feet at the bottom and 4 feet near the top, which annular chamber is to be filled with sufficient masonry to sink the bell-shaped caisson to a floating depth 28 feet in the water. The entire structure is framed and braced like a ship and planked in the same way. It is expected the caisson will be built in Portsmouth, Va., and towed in about two days to the designated site, which has a depth of 30 feet of water. There it will be sunk or grounded. Then the wall built up between the two walls and the sand in the interior to be drawn up by suction pumps worked probably by gasoline engines. As soon as the caisson is well sealed at the bottom compressed air will be admitted to the working chamber, which will be about 9 feet in height, and workmen will dig out the sand in the usual way under the edges of the structure, permitting the whole to sink possibly to a depth of 30 feet or more in the sand until a solid foundation is obtained. After this the central chamber, 6 feet in diameter, is filled, first by a wall being laid, on which the structure rests; then the chamber is filled with sand or other material, which completes the work. After this the steel superstructure, including the spiral steel stairway, is built. The masonry work is to be carried up 90 feet from the extreme bottom.

The lamps can be lighted when the structure is first towed to sea and showed nightly, if desired, while the work is going on.

The lens will be placed in a room at least 10 feet high, where nearly all the intricate mechanism for working the light and feeding the immense burners will also be situated. On the outside of this structure will be a high railing and promenade where the keepers and their families may take outings and observe the waves 200 feet below. Either a steady light or one of the flash order can be placed in the structure under the design; but as all first-class-order lighthouses hereafter will be provided with the quick-flash light, it is probable when Capt. Eells' design is accepted, that this character of light will be placed in it. A space has been provided for a powerful siren. An equipment of wireless telegraph apparatus is likely to be provided, besides local telephones between the base and the living apartments above.

By making the structure exceptionally strong and solid with steel and masonry, it is believed that it will be well able to withstand the fury of the sea at this notable locality.

The inventors' models in the possession of the Canadian Patent Office have been turned over to T. C. Brigham, of Detroit, Mich., and it is announced that they will be classified and grouped in such a manner as to best demonstrate the progress of the country in this particular direction, after which they will be given over to the custody of universities and museums in different parts of the country.

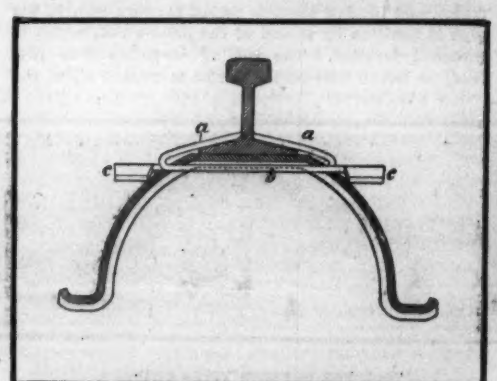
The public schools of Chippewa Falls, Wis., have sent an exhibit to be displayed in the Palace of Education at the World's Fair.

IMPROVED RAILWAY SUBSTRUCTURE.

We illustrate herewith a novel support for the rails of a railway, which is so designed as to evenly distribute upon the roadbed the concentrated weight imposed thereon by the wheels in passing over the rails. Aside from thus distributing the load and affording a continuous support for the rails, this improved railway construction provides a simple but rigid fastening for the rails, which holds them in place without the use of bolts and nuts. The rail support or girder, it will be observed, has the form of an inverted steel trough, with its two edges curved upward to form flanges on which the girder rests. The rail is held in place on the flattened top of this girder by means of steel clips arranged in pairs to grip the base flange of the rail on opposite sides. Each clip consists of a metal plate, *b*, formed with an ear *c* at one end, and a hook *a* at the other, the latter being adapted to fit over the base flange of the rail. The plate or main body of the clip passes under the rail through openings in the steel girder, and is held securely in place by the ear *c*, which is bent down on the outside of the girder. The hook portion of the clip is preferably formed with a rib, which serves to greatly strengthen it and prevent it from bending open. The girders are formed with inset portions at regular intervals to receive the tie pieces, by which they are held and accurately spaced apart. These tie pieces consist of inverted metal channels having their side walls cut at the ends to form ears, which are bent outwardly through slots in the girders, thus firmly securing the tie pieces to the girders. Each girder is formed with a reduced portion at one end, which serves as a slip joint for the overlapping end of the next adjacent girder.

TAMPING THE BALLAST UNDER THE GIRDER FLANGES.

In laying a track with these girders, the roadbed is first prepared, as in the usual way, for wooden cross-ties, and is covered with ballast to a depth of about three inches. The girders are then placed in position, and spaced to the proper gage by the tie pieces. As each girder is placed in position, as much ballast as possible is crowded under it from the end. Each girder overlaps the preceding one for a distance of six inches. The girders are each 7½ feet in length, or one-quarter the length of an ordinary rail; and it is, therefore, possible, on laying the rails on the girders, to bring the rail joints in each case at the center of a girder. After the rails have been securely gripped by the rail clips, the ballast is tamped under the sides of the girders, to give them a firm and even bearing, and also to bring the track to the required elevation and alinement. The roadbed is then completed by laying ballast between and outside of the girders.



CROSS-SECTION OF THE GIRDER.

Mr. Samuel E. Duff, of Allegheny, Pa., who is the inventor of this track construction, has laid several experimental sections, both of steam railways and street railways, which have given great satisfaction. Practical men who examined the girders made the criticism that it would be impossible to tamp the ballast perfectly under them, and that the girders would spread out at the bottom under the loads they had to support. This criticism was dispelled by an experiment, in which a short track section was set up with the girder flanges resting on oiled steel plates, and then subjected to a load of 100,000 pounds, which failed to produce any perceptible vertical deflection. When the load reached a weight of 25,000 pounds, it was observed that the girder had spread five-sixteenths of an inch at the flanges, after which scarcely any change was noticeable as the load was increased to 100,000 pounds. This remarkable showing under the worst conditions possible speaks well for the rigidity of the girders, and makes it virtually certain that no deflection would occur in practice when they were partially supported by the ballast of a roadbed.

STEEL SUBSTRUCTURE FOR RAILWAYS.

The Rusting of Stove Pipes—Its Cause and Prevention.

BY JOHN M. BLAKE.

The ruinous rusting of stove pipes is a matter that is often forcibly brought to the attention of users of anthracite coal stoves. Pipes which have been in use for two or three years will sometimes become so eaten by rust that little metallic iron is left, and the pipe will crush in the hand. This destruction is more rapid and complete than with the ordinary weather-rusting of sheet iron.

The cause is generally attributed to the sulphur in the coal. There is not much doubt that the destruction of the mortar in chimney tops is due to the sulphur acids; but some experiments made by the writer a number of years ago, resulted in showing that the sulphur has little to do with this injury to pipes. The true cause is the production of ammonia compounds during combustion. Both the chloride or sal-ammoniac and the sulphate are formed in the pipe, and mix with the ashes and soot. It remains harmless during the dry, cold weather, but readily absorbs moisture by contact with damp air as warm weather comes on, when its action begins, and continues so long as the cause remains. The effect of sal-ammoniac to induce rusting in iron is well known. It is also well known that bituminous coal gives off ammonia when distilled—the supply obtained at the gas works being considerable. We would hardly expect anthracite coal to produce an appreciable quantity; but when the writer mixed a little slaked lime with some dust taken from flues or pipes, a strong smell of ammonia was developed, thus practically demonstrating that this salt is produced in quantity sufficient to cause injury.

The season is approaching when stove and furnace pipes will be put away for the summer; and knowing the cause of this vexatious rusting, we must look for the remedy.

The removal of the ammonia salt is a matter involving difficulties. If we start with a new pipe, and brush out every particle of dust before the dampness has been absorbed, the removal will be complete, and no harm will ensue. This, however, is an exceptional case. In our climate, we are often obliged to keep up our stoves and furnaces through the first warm, damp days of May, and sometimes early June. When rust has once commenced, and particularly in the case of neglected pipes, the crust of rust persistently holds the ammonia salt.

Two ways seem to effect its removal from the pipes. First, by immersing and thoroughly soaking the separated sections for several hours in water—running water, if possible; and second, by roasting the pipes over a fire to a red heat. In my experiments, both methods were tried with equally satisfactory results. The pipes, however, in the second method, must be heated to a dark red to completely drive off the ammonia compounds. A stove that could be heated throughout by a brisk wood fire just previous to removal for storage, might be made immune—as well as its pipe—so far up as the intense heat had reached; and it has been found of advantage to soak and wash the removable parts of a kitchen stove, before leaving the same unused for the summer. In the instance tested, this course prevented the rusting that previously had regularly taken place.

The accumulation of ammonia salts seems to be slow. Just a few fires in a stove do not appear to leave the destructive element in serious quantity. The rusting effect on cast-iron furnace flues is to form a scale to a limited depth every summer, which gradually thins the cast iron. Under the same conditions, wrought-iron pipes or flues would be penetrated, unless of good thickness.

After testing a number of samples at different times, the ammonia compound was found to be in some cases the chloride alone. Sometimes it was a mixture with sulphate, and in one instance there was present only the sulphate.

The dust from furnace flues has considerable value as a fertilizer. The ammonia will show its effect very noticeably in the increased vigor of the growth of grass on parts of a lawn where the experiment is tried.

Many Methods of Carrying Mail.

The many methods of carrying the mail in the past and present are shown by the United States post office department in the Government building at the World's Fair. The exhibit contains pictures and models and a real Alaska dog sledge used for carrying the mails in the far North. To this sledge are attached a train of Alaska dogs, mounted and harnessed, looking as natural as if alive. This train doubtless has covered many miles over the bleak and frozen territory in the far North, carrying Uncle Sam's mails.

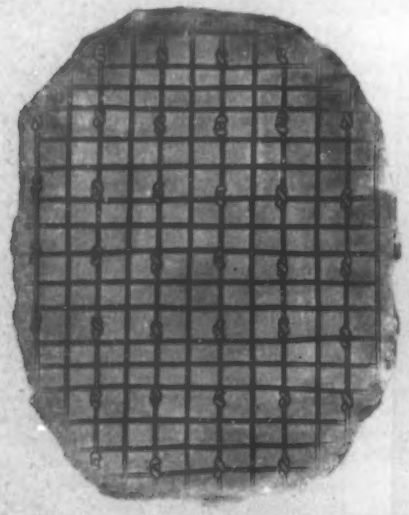
The cowboy mail carrier on his trusty steed, galloping across the plains with his letter pouch, the footman carrying mail through the dense forest, and the mail carrier on snowshoes in the great timber districts of the North, are also shown in this exhibit, and there is a horse sled and an old-style buckboard, a reindeer sledge and an Esquimaux driver.

Coming closer to civilization, the rural mail wagon and city mail wagon, the electric mail car and the postal car, as used on the great railways of the country, are exhibited, giving World's Fair visitors an idea of the magnitude of Uncle Sam's mail-carrying business.

J. R. Freeman, of the Metropolitan Water Board of Massachusetts, is the authority for the statement that Boston is sinking into the sea. He asserts that the present datum plane, to which all elevations are referred by the engineering department of the city of Boston, and which is commonly known as Boston base, probably coincided almost exactly in the year 1830 with the mean low water at the Charlestown navy yard. To-day, after a lapse of seventy-two years, the same datum plane, as defined by numerous bench marks on solid ground, according to the best available determination is 0.79 foot below mean low water. This comparison shows that the land now stands about 0.79 foot lower relatively to the sea than it did about seventy-two years ago, and shows that the land in Boston and vicinity is sinking at the rate of about one foot per hundred years.

A NEW TENNIS RACKET.

A new racket for playing lawn tennis, court tennis, and rackets has been brought to our attention, the novel feature of which is to be found in its knotted strings. The efficiency of a rough surface has long been recognized. The principle is exemplified in the



A TENNIS RACKET WITH KNOTTED STRINGS.

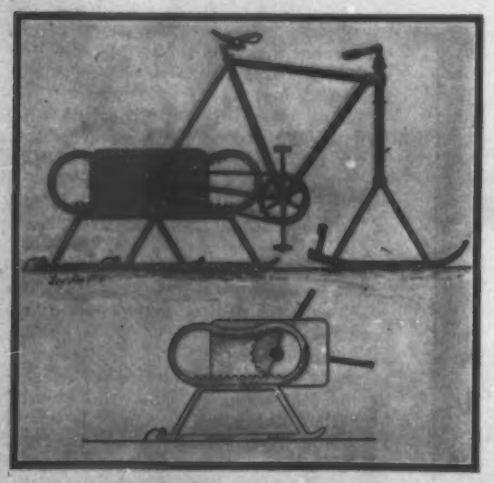
chalked tip of a billiard cue, and in the sandpaper surface of the ping-pong bat. But so far as we know, no one has hitherto succeeded in getting an equally effective instrument for players of tennis and analogous games.

The inventor of the new racket, Mr. J. E. Hindon Hyde, of 120 Broadway, New York city, has solved the problem by forming knots in the strings themselves, so that the strings can be independently stretched to the required tightness, and the knots can be placed at the desired points. This new racket seems to present possibilities. Among these are the advantages in delivering a twist service, and the security of grip on the ball, thus permitting accurate placing. The opponent's twist or "cut" also can be neutralized and even reversed by the user of this racket.

Mr. Wylie C. Grant won the Indoor National Tennis Championship of the United States last winter with one of these rackets.

RUNNER ATTACHMENT FOR BICYCLES.

An inventor in Montana has devised a very ingenious scheme for making his wheel serviceable in winter weather. This he does by substituting a single forward steering runner and a pair of rear propelling runners for the wheels of his bicycle, so that the vehicle may be propelled over snow and ice. The propelling runners are so constructed and operated by the usual pedal movement that they will be alternately lifted and advanced, one runner of a pair bearing the weight of the machine, while the other is being lifted and brought forward. Each propelling runner is attached, at its upper end, to a mangle rack, and these racks are engaged by gear sectors mounted and keyed to the rear axle of the bicycle. It will be observed that the bottom sections of the racks are straight, the upper sections are inwardly convexed, and that no

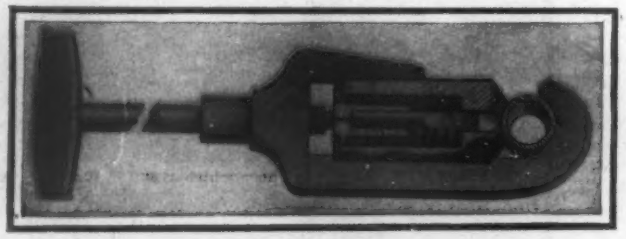


RUNNER ATTACHMENT FOR BICYCLES.

teeth are formed on the end sections of the rack. The gear sectors face in opposite directions, and are rotated by the usual chain-and-sprocket connection with the pedal cranks. During the first half of each rotation, one of the sectors will engage the straight section of one of the racks, moving the wheel forward thereon, while the other sector will lift and advance the other rack by engaging its convex portion; then during the second half of the rotation, the former rack will be advanced, while the latter will remain stationary. Stop arms are hinged to the rear end of each runner, to hold it stationary while it carries the weight of the wheel. The forward or steering runner is formed with a knife edge at the rear, which may be pressed into the ice or snow by a twist of the handle bars to retard the progress of the vehicle, thus acting as a brake. A patent for this improved runner attachment has been granted to Mr. John H. Youngken, of Virginia City, Mont.

PIPE OR BAR CUTTER.

In the accompanying illustration we show a simple and inexpensive tool for cutting pipes, tubes, and bars of metal, which has been patented by Mr. William T. Snell, of Octave, Ariz. The tool may be adjusted to fit and securely hold any size of bar or pipe while the cutting operation is being performed, and the arrangement is such that the depth of cut made by the tool will be regulated by the pressure exerted on the handle by the operator. As clearly shown in our engraving, the main body of the pipe cutter is formed with two arms, one of which is longer than the other, and terminates in a hook or jaw. Mounted to slide between these arms is a rectangular jaw block formed with a central chamber, into which a tubular stud extends. This stud has a slightly tapered bore, which receives the shank of the cutting tool. A heavy coiled spring in the chamber bears against a collar formed on the outer end of the tubular stud, which is retained in the jaw block by a plate bearing against the opposite side of this collar. The handle of the pipe cutter is formed with a rod, which is threaded through the main body of the device, and bears against the end of the tubular stud. In practice the bar or tube to be cut is placed between the inclined walls of the jaw of the main frame, and the jaw block is moved forward to hold the pipe in position by means of the handle rod, which is threaded forward. The cutting operation then proceeds as usual, that is, the device is rotated about the



TOOL FOR CUTTING PIPES OR BARS.

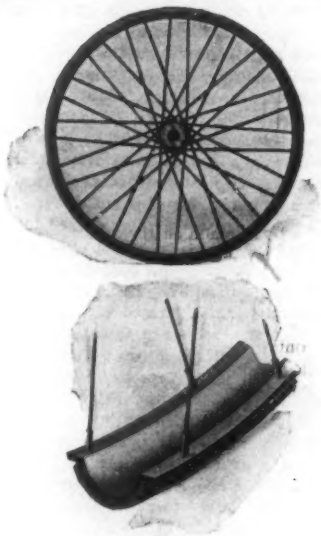
pipe, and the tool is fed forward as desired by screwing the handle rod forward. The pipe or bar will then be cut without any bulging, as is apt to occur with other tools now commonly in use.

A Huge Dam.

The construction of a tremendous barrage, rivaling even the recently completed huge Aswan dam on the Nile, is shortly to be commenced upon the Tunga Barda River near Hospet, in the extreme western corner of the Madras Presidency, British India. The sources of the Tunga Barda are in the western Ghats, and the course of the river is eastward across India, flowing 400 miles to the sea. The scope of this projecet is to construct a dam nearly a mile long by about 150 feet in height, thereby forming a huge reservoir approximately 40 miles in length and covering an area of 150 square miles. By means of this Titanic project some 200,000,000,000 cubic feet of water—about five times the capacity of the Aswan reservoir and equal in area to about three times that on the Nile—will be available for the irrigation of the surrounding country. The cost of this gigantic project is estimated at three and a half crores of rupees; but owing to the extent of country it will be able to irrigate, it is anticipated that the scheme will be a most paying one.

VEHICLE WHEEL.

A patent has been granted to Mr. Carl Rondell, of 925 Fourteenth Avenue, South, Minneapolis, Minn., on a new type of vehicle wheel which provides a cushion-tread surface of very great strength. The wheel rim, as illustrated herewith, is formed with a central outwardly offset section; in other words, it has the form of a trough with side flanges along each edge. The spokes are secured at one end to these flanges and at their opposite ends to the hub. The rim is preferably made of aluminium, although any suitable material may be used, and the tire is a cushion tire, being preferably made of solid rubber, although an inflated tire may be employed. The tire is endless and is perfectly fitted to the outer convex surface of the central member of the rim. Although the tire will remain on this offset member without being secured thereto, it is preferably attached to the rim by a cement or other well-known means, so as to prevent it from creeping. A wheel constructed in this manner is adapted for use in connection with any form of wheeled vehicle, and is



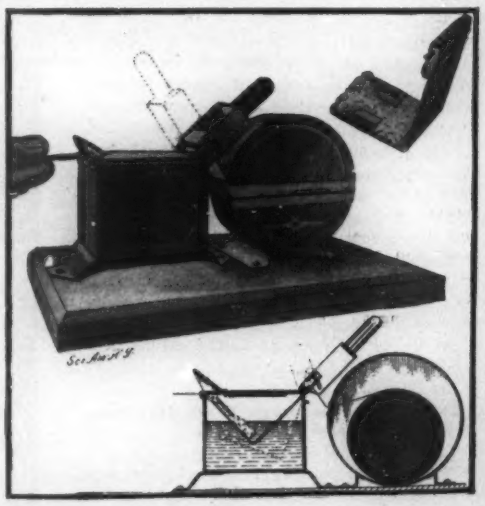
VEHICLE WHEEL.

exceedingly strong and durable, and well adapted for use on roads of any description.

MACHINE FOR MOISTENING GUMMED PAPER STRIPS.

A patent has recently been granted to Mr. J. E. Colvin, Box 354, Junction City, Kan., for a machine adapted to moisten gummed paper strips, such as are used to close and seal paper bags or other packages in lieu of trying them with twine. The paper strip or tape, wound up into a roll, is carried in a sheet metal drum or holder, mounted on the baseboard of the machine. Access to the holder is had through a door in a side face of the drum. Upon the baseboard near the holder, and in alinement therewith, a rectangular sheet metal chamber or water reservoir is mounted, and the paper tape which passes out through a slot in the holder is led into this chamber, through guides under its lid, and then out at the opposite side. Pivoted at one end within the reservoir is a plate bent to a right angle at its center and carrying at its free end a sponge which bears against the gummed paper at the point where it emerges from the reservoir. The lower end of the sponge dips into the water of the reservoir.

Just above the hinges, the plate is formed with a head provided with outwardly extending pivot bolts which project through curved slots in the side walls of a bracket frame hinged to the water reservoir. This bracket frame is formed with a heavy handle, whose weight, when the bracket frame is thrown to the position illustrated, serves to hold the sponge against the gummed paper. When, however, the handle is thrown forward, the bent plate rocks downward, immersing the sponge in the water. This provides a



MACHINE FOR MOISTENING GUMMED PAPER STRIPS.

means for moistening the sponge in case the capillary attraction is not sufficient to keep its upper end moist.

In use it is merely necessary to draw forward the desired length of gummed paper, which will be moistened as it is drawn forward, and then to cut it off by bending it backward against the V-shaped cutter formed on the lid of the reservoir.

Legal Notes.

A WATER STILL INFRINGEMENT CASE.—James W. Hale brought an action against the World Manufacturing Company for infringement of letters patent granted to him for an improvement in water stills for the distillation of water for domestic purposes. The Circuit Court dismissed the bill, on the ground that the water still manufactured by defendant did not infringe any of the claims of the patent sued upon. From this decree the complainant appealed, but the Circuit Court of Appeals (127 Fed. Rep. 964) affirmed the decision.

The Hale apparatus is simple enough. It consists of three separable parts—a boiler, in which the water to be distilled is contained; a collector for the distilled water, which fits on top of the boiler, and a condenser containing cold water for condensing the steam, which fits on top of the collector. The essential and patentable feature of the invention is a sterilizing chamber, consisting of the upper part of the boiler above the water, into which air is admitted and carried across the surface of the water through the steam, to a passage opposite the inlet, through which it passes, mixed with the steam, to the condenser.

The defendant's still is also composed of three separable parts—a boiler, a collector, and a condenser arranged to fit together in the order named. The collector, however, has no bottom or floor to serve as the top of a sterilizing chamber, but the steam rises directly from the boiler through the central opening into the condenser chamber. No attempt is made to confine the steam between the floor of the collector and the surface of the boiling water, so as to sterilize the air by compelling it to pass over the entire surface of the boiling water and mingle with the scalding steam before rising, through the steam passage, into the condenser.

An examination of the prior art satisfied the court that, before Hale took out his patent, patents had been issued for water stills consisting of three separable parts—a boiler, a collector, and a condenser—and also for water stills having air inlets to admit air for aerating purposes, and likewise water stills containing provisions for purifying and sterilizing the admitted air.

Since there was no attempt to confine the steam in a chamber for sterilizing purposes in the defendant's apparatus, and for compelling the air to pass over the entire surface of the boiling water and mingle with it, the essential element of the Hale patent was lacking in defendant's device.

SOME ELEMENTS OF PATENT LAW.—In the case of Sanders v. Hancock (128 Fed. Rep. 424) the court laid down with such admirable clearness the elements of patent law, that we feel prompted to quote below a few of the remarks made: It is well settled that a mere conception or idea of a desirable function or result, resting in the mind, which might be obtained by a machine or device, is not invention, either for the purpose of obtaining a monopoly, or for the purpose of making the defense of prior invention. Invention in the legal sense must involve a practical, successful, operative device. It must be a perfected invention, and either put to practical use, or be clearly capable of such use, and the novelty of an invention is not negatived by a prior useless process or thing. Nor is anticipation made out by a device which might, by slight modification, be made to perform the same function, if the prior invention were not designed by its maker nor adapted to actual use for the performance of such function. Another well-settled proposition is that even in a combination patent infringement is well established whenever the alleged infringing device accomplishes the same result, and substantially in the same way. And mere colorable and immaterial difference in the mechanical arrangement and adjustment, or difference in the form of parts of the structure, or methods of fastening or bolting such forms together, does not avoid infringement, as omitting an element, so long as the same result is obtained, and substantially in the same way. Nor for similar reasons will an immaterial addition avoid infringement. No rearrangement or transposition of the parts or substitution of one thing for another avoids infringement, so long as the fact remains that the same result is worked out in practically the same way.

Attention may be called to the now well-established doctrine of the recent cases in regard to combination patents, which put those inventions on a different footing from what the tendency of the reasoning of the older cases put them. The older cases are well calculated to create the impression that a combination patent must in all cases receive a narrow construction, and that such an invention is hardly entitled to the benefit of the doctrine of equivalents. It has been demonstrated, and particularly in recent years, that patents which satisfy in the highest degree the requirements of the public, and a growing and complex business establishment such as ours, are not limited to the class called the primary or pioneer patents, but include combination patents. Indeed, the practical utility, and the change from failure to success, is shown in the highest degree in combination patents, and in view of this a more liberal attitude is now shown toward such patents. In the case of Brammer v. Schroeder, 106 Fed. 918, 920-921, 46 C. C. A. 41, the result of the more modern cases is restated by Judge Sanborn in the following language: "One who invents and secures a patent for a machine or combination which first performs a useful function is thereby protected against all machines and combinations which perform the same function by equivalent mechanical devices. . . . In other words, the term mechanical equivalent, when applied to the interpretation of a pioneer patent, has a broad and generous signification. This general rule of law, like every other principle of jurisprudence, applies equally to all patents, whether for combinations, machines, or combinations of matter. If, however, one invents and secures a patent for a new combination of old mechanical elements, which first performs a useful function, he is protected against all machines and combinations which perform the same function by equivalent mechanical devices, to the same extent and in the same manner as one who invents and patents a machine or composition of matter of like primary character. The doctrine of mechanical equivalents is governed by the same rules, and has the same application, when the infringement of a patent for a combination is in question as when the issue is over the infringement of a patent for any other invention."

And in the case of Keystone Manufacturing Company v. Adams, 151 U. S. 139, 14 Sup. Ct. 295, 38 L. Ed. 103, Mr. Justice Shiras, speaking for the court, said: "Where the patented invention consists of an improvement of machines previously existing, it is not always easy to point out what it is that distinguishes a new and successful machine from an old and ineffectual one. But when, in a class of machines widely used, it is made to appear that at last, after repeated and futile attempts, a machine has been contrived which accomplishes the result desired, and when the Patent Office has granted a patent to the successful inventor, the courts should not be ready to adopt a narrow or astute construction fatal to the grant." In the case of Westinghouse v. Boyden Power Brake Company, 170 U. S. 537, 18 Sup. Ct. 707, 42 L. Ed. 1136, Mr. Justice Brown, speaking for the court, said: "The fact that this invention was first in the line of those which resulted in placing it within the power of an engineer, running a long train, to stop in about half the time and half the distance within which any similar train had stopped, is certainly deserving of recognition, and entitles the patent to a liberality of construction which would not be accorded to an ordinary improvement upon prior devices." In another of these Westinghouse cases, namely, Westinghouse Air Brake Company v. New York Air Brake Company, 63 Fed. 962, 11 C. C. A. 528, Judge Shipman, giving the opinion of the Circuit Court of Appeals for the Second Circuit, said: "It is not important now to determine the grade of its pioneership, and whether it may be classed in the list of those inventions which are of the highest rank; but it was an invention created to achieve great necessities and overcome great hindrances, and was one of wide breadth. A court would not be justified in adopting a 'narrow or astute construction' which would minimize the character of the invention, leave its real scope open to trespasses, and thus be 'fatal to the grant.'"

PROCUREMENT BY FRAUD—REMEDY OF ACTUAL INVENTOR.—The Standard Scale and Foundry Company filed a bill in equity to enjoin McDonald from the use of a certain patent, and for an accounting to the complainant. The substance of the bill is that in 1901 one Darius M. Orcutt invented and perfected a wagon scale, known as the "Pitless Scale;" that said Orcutt was employed in 1901 by the defendants to superintend the manufacture and sale of wagon scales at their factory in this State, during which time he made and applied the discovery in question; that he filed an application for a patent on his invention, and that he was afterward informed, and for the first time learned, that the Commissioner of Patents, on an application for letters patent for said invention theretofore filed by two of the defendants, had granted the defendants letters patent therefor, issued on the 17th day of February, 1903; that the said patentees were not the original and first inventors of said device, and that they had obtained the same by fraudulent representations to the Patent Office, and in fraud of the rights of the first and original inventor; and that the complainant became the owner of all the rights and interest of Orcutt in said invention, by a proper deed of assignment, which had been duly filed in the office of the Commissioner of Patents.

To this bill the defendants demurred.

The question to be decided was where A claims to be the original inventor of a patentable device, for which he is entitled to a patent from the United States, and B has wrongfully and surreptitiously, in fraud of the rights of A, obtained a patent from the government for the invention, has he a standing in a court of equity to enjoin B from the use of the patent, and for an accounting?

"As the exclusive right of the inventor to the use of his invention does not exist at common law, but depends alone upon legislative action, Congress has the power to prescribe the method and procedure by which such exclusive right shall be obtained. To this end, Congress has created a department known as the Patent Office, to which is committed the whole matter of procedure in obtaining patents. To that department the original inventor must first make his application for a patent, accompanied with suitable specifications, and certain descriptive, intelligible data. These are referred by the commissioner to a designated board of examiners, who, by reason of their learning and experience in such matters, are experts, presumably peculiarly qualified for determining whether the given device possesses the requisite qualities of an invention, as distinguished from mere mechanical skill; whether or not it be a practicable and useful device; and whether it has been anticipated in use by some other invention, or conflicts with some other patented grant. It does seem that it never was the mind of Congress that the inventor, without complying with the statuory scheme of submitting his claim to the Patent Office for its action thereon, could go into a United States court in the first instance to have determined the question of his right to a patent, and the exclusive use of the claimed invention."

"The bill discloses that, prior to the issuance of the patent to the defendants, the application of Orcutt to the Patent Office for a patent was filed. This brought the case precisely within the provision for a patent, conflicting with a 'pending application'; thus devolving upon the commissioner the duty imposed by the statute to give the required notice and proceed to the hearing, etc. While the bill is silent as to whether or not the commissioner observed the statute in this respect, the presumption is always to be indulged that the public officer did his mandatory duty."

"As persuasive proof that it was never contemplated by Congress that the mere claimant to an invention not patented, without more, could maintain a suit in equity against the patentee, is the provision of section 4915 of the statute [U. S. Comp. St., 1901, p. 3393] which provides as follows;

"'Whenever a patent on application is refused, either by the Commissioner of Patents or by the Supreme Court of the District of Columbia upon appeal from the commissioner, the applicant may have remedy by bill in equity; and the court having cognizance thereof, on notice to adverse parties and other due proceedings had, may adjudge that said applicant is entitled, according to law, to receive a patent for his invention, as specified in his claim, or for any part thereof, as the facts in the case may appear. And such adjudication, if it be in favor of the right of the applicant, shall authorize the commissioner to issue such patent on the applicant filing in the Patent Office a copy of the adjudication, and otherwise complying with the requirements of law. In all cases, where there is no opposing party, a copy of the bill shall be served on the commissioner and all expenses of the proceeding shall be paid by the applicant, whether the final decision is in his favor or not.'

"This statute shows that while Congress required the inventor to submit his claim for patent, in the first instance, to the patent department of the government, it did not intend that so valuable a thing as the inventor might obtain through the grant of a patent should be subject to the final arbitrament of that department. Why should Congress thus declare that, if the application for a patent should be refused either by the Commissioner of Patents or the Supreme Court of the District of Columbia, 'the applicant may have remedy by bill in equity,' if such remedy existed even in advance of any such adverse action by the Commissioner of Patents or the Supreme Court of the District of Columbia? The enactment would have been an act of supererogation."

"As only the exclusive owner is entitled to call in question the use of his invention by a third party, and he cannot be such exclusive owner with such right until he has obtained a patent, it should follow that the complainant is not entitled to call upon the defendants for an accounting, and to enjoin them from the further use of the invention, until it has obtained the statutory evidence of such exclusive right, which is a patent. Whether or not the complainant, in the event it obtains such patent, can compel the defendants to account for profits earned by them prior to the grant of a patent to the complainant, is not involved in this litigation. As the court has the right to assume that the complainant is prosecuting his application before the Commissioner of Patents as the statute contemplates, what is here held is that this suit is premature."

The demurrer was therefore sustained.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

COUPLING FOR ELECTRIC WIRES.—B. G. Castillo, Mexico, Mexico. In this patent the invention relates particularly to improvements in couplings for trolley-wires of electric railways, an object being to provide a coupling of simple construction and so arranged that should a trolley-wire break and its end fall to the ground the fallen section will be wholly cut out of electrical connection, and thus prevent the possibility of accident from an electric current.

ELECTRIC BLOCK-SIGNAL SYSTEM.—T. Silvens, Victoria, Canada. This signal is intended for use upon railways. Mr. Silvene's object, more particularly, is to produce a neat, reliable, and simple system whereby a train may automatically display a danger-signal in the block upon which it stands and in the block ahead and may automatically display a safety-signal in a block to the rear. The system is applicable to single or double tracks.

ELECTRIC SIGNAL SYSTEM.—O. Ernst, Larchmont, N. Y. The invention relates to electric signaling, and more particularly to the production of a simple and reliable signal for use in connection with electric railways and adapted to warn the engineer at the power-house and the motorman whose train happens to be near the seat of trouble upon a particular part of the line.

TROLLEY.—J. A. Lavery, New York, N. Y. In this patent the invention has reference to improvements in trolleys used in connection with the overhead wires of electric railways, an object of the inventor being the provision of a simple and novel means for preventing the accidental displacement of the trolley from the wires.

Hardware.

MITER-BOX.—J. J. Mabbs, Harrison, Ark. In this instance the invention relates to woodsawing; and the object is the provision of a new and improved miter-box adapted to be adjusted to allow the user to accurately produce on the side or face of the timber or other work a cut of any desired angle. It is understood the box may be used for other purposes.

Hydraulics.

HYDRAULIC PRESS.—P. W. Fuller, Dorchester, Mass. This invention pertains to improvements in hydraulic presses or similarly-actuated devices, an object being to provide a press of very simple construction in which two different liquids are employed in connection with an equal arm-lever, whereby a press of great efficiency is provided.

MECHANISM FOR RAISING LIQUIDS FROM DEEP WELLS.—T. F. Moran, De Young, and F. J. Mosbe, Kane, Pa. This invention relates to mechanism for raising liquids from deep wells. The air pipe is provided at its lower end with a self-closing valve which cuts off egress of air as soon as the pressure thereof within the air pipe drops below a certain limit. A casing encircles the air pipe, and is provided with an inlet valve so disposed that the fluid in the well maintains a constant level and the formation of paraffin is reduced to a minimum. The well is provided with sand traps which prevent evil effects from the inflow of sand.

Lighting and Heating.

CARBURETER.—D. D. Ramsey, Payette, Idaho. The aim of the invention is the provision of a new and improved carbureter, very effective in operation, and arranged to cause a proper vaporization of the oil and the mixing of the oil-vapors with air to insure the formation of a rich and readily-combustible gas.

MINER'S CANDLESTICK.—E. W. Packer, Mace, Idaho. In this instance the invention has for its object to provide a candlestick formed entirely from wire of novel simple form that adapts the candlestick for every convenient use and greatly cheapens the construction, the invention being well adapted for use in mining for metals that are contained in quartz rock. The wire may be of steel or iron of any suitable gage.

HEATER.—B. I. Mahon, Sanborn, Iowa. The object of the invention is to provide a water and air heating attachment for stove-pipes, the same being in practice applied to the pipe at any desired point and generally in a room separate from that in which the stove or furnace is located. The attachment utilizes the heat derived from the products of combustion passing through the pipe and is adapted to contain water, which may be drawn off for any purpose and at the same time radiate heat into the apartment.

Machines and Mechanical Devices.

APPARATUS FOR TREATING NEGATIVES AND PRINTING-PLATES.—W. G. Thorpe, St. Paul, Minn. In this patent the invention is an improved apparatus for drying photographic negatives after developing and for treating half-tone and other printing plates by means of an etching solution to produce a relief-surface thereon and by subsequently developing and washing such surface.

MECHANICALLY-ACTUATED ORGAN.—C. I. D. Looff and F. A. Knapp, Brooklyn, N. Y. The object of this invention is to provide a new and improved mechanically-actuated organ arranged to play a number of long pieces of music successively without requiring a change of note-sheet, the organ being more especially designed for use on merry-go-rounds and in halls, pleasure grounds, and other places of amusement.

BOTTLE-CORKING MACHINE — J. F. Schneider, New York, N. Y. This invention relates to improvements in bottle-corking machines in which the several operations are automatically performed by the act of placing the bottle in the holder; that is, on the introduction of a bottle the machine is started, the bottle is raised, the cork is fed to a position over the bottle, and the cork driven in, after which the machine is thrown out of gear and stops, so that the corked bottle may be removed by an operator.

BOLT-TURNING HEAD.—B. Dek. Jackson, Altoona, Pa. Mr. Jackson's invention has reference to improvements in devices for turning bolts, rivets, or the like, an object being to provide a turning-head by means of which the work may be rapidly done and which may be quickly adjusted for different sizes of bolts.

MACHINE FOR GRINDING CUTTERS.—E. Schroeder, New York, N. Y. The object of the invention is to provide a new and improved machine more especially designed for accurately grinding rotary cutters—such, for instance, as is used in a fleshing and shaving machine for raw or dressed furs or skins, for which former Letters Patent have been granted to Mr. Schroeder. The operations of this machine do not require the employment of highly-skilled labor.

APPARATUS FOR COALING BOATS.—H. D. Stearns, New Orleans, La. In this case the invention relates, generally stated, to apparatus arranged on a coal-barge employing coal elevating and discharging means and suitable power means, also on the coal-barge, adapted for operating the elevating and discharging means. Coal breaking and weighing devices form a part of the apparatus as a whole.

GRINDING-MILL.—G. C. Erenzel, Franklin, Tenn. This invention relates to improvements in mills designed for use in connection with roller flour-mills, and particularly adapted for grinding pure middlings, fine flat middlings, flat tailings, and low grade stock, an object being to provide a machine by means of which the work may be rapidly and thoroughly done.

Of Interest to Farmers.

AUTOMATIC GATE.—R. Bolinger, Sheridan Lake, Col. Operating means in this gate act gradually in opening and closing it, avoiding jars and shocks. Springs transmit movement of operating devices to the gate so that movements of the gate will be gradual and shockless and the pull of the devices will not be exerted directly on the gate but on the springs and through these to the gate. Means are provided so that whether the devices are pulled quickly or slowly the gate will move at about the same speed. Means provide that the gate will be opened and closed by the springs with ample time for both movements.

REEL FOR PLANTERS.—J. H. Grooters, Allendorf, Iowa. The invention relates to an attachment to planters of that type which is provided with a guide wire, chain, or cable, one end of the wire, chain, or cable being adapted for attachment to a stake fastened to the ground at one end of a proposed row, the other end of the wire, chain, or cable being adapted for attachment to a reel mounted to rotate at the rear of the machine, and is a division of the application for an improvement in planters formerly filed by Mr. Grooters.

PLOW.—W. T. George, Fayetteville, Tenn. In this case the invention relates to improvements in reversible double-shovel plows, an object being to provide a plow of this character so arranged that changes can be quickly made to place either shovel in advance of the other while plowing on a side hill, so that the dirt will be thrown in the same direction in both furrows.

MACHINE FOR PULLING STALKS.—G. M. Kirkpatrick, Ennis, Texas. The purpose in this instance is to provide a machine for pulling up corn and cotton stalks by the roots and breaking the stalks in small pieces and to provide a construction wherein the stalks will be guided to the pulling-section of the machine and the pulling-section may be adjusted to suit the average height of the stalks and bodily raised and lowered at any time to permit the pulling-section to be carried out of the way of obstructions.

Pertaining to Vehicles.

AXLE-OILER.—J. C. Lambert, Tonica, Ill. Mr. Lambert's invention has reference to improvements in oilers for vehicle-axle skeins, an object being to provide an oiler of simple construction and consisting of few parts and that can be readily removed or replaced with the hub-nut without interfering with the oil in the cup.

CARRIAGE-TOP.—L. C. Shipley, New York, N. Y. In this patent the invention relates to improvements in carriage-top frames, an object being to provide a frame so constructed as to fold compactly when not in use. In folding the several standards swing inward toward each other, and the several members when folded lie on studs. The invention is not confined to a carriage-top, as it may be used for awnings on boats or otherwise placed.

Railways and Their Accessories.

COUPLING FOR AIR-BRAKE HOSE.—A. F. Allan and J. A. Lenhoff, Wilmington, Del. These coupling improvements are upon a device for which the inventors were allowed a former patent, and provide spring-supports for the locking-terminals of the hose connected with the air-brake, which supports serve to hold the terminals in correct position when uncoupled and assure coupling of opposing locking-terminals, which terminals when coupling is effected are in proper alinement, occupying certain positions, according to whether the couplings of opposing cars are the same distance from the ground or higher or lower than the other, in which position they are held while coupled by means at the outer end of the locking-terminals.

CUSPIDOR FOR CARS.—R. T. Cummins and O. P. Ivie, Sheffield, Ala. The object of this invention is to provide novel details of construction for a stationary cuspidor located between seats of a passenger railroad-car and which is self-closing at its upper end, is convenient to open for use by the occupants of either seat, is open at its lower end, is readily cleansed, is strictly sanitary, and affords a necessary accommodation to the travelers.

Of General Interest.

BANANA-HOLDER.—E. W. Lyons, Chicago, Ill. The invention relates to improvements in devices for holding bananas or similar fruit for transportation, an object being to provide a device for this purpose of simple construction, inexpensive, and in which fruit may be readily handled without danger of breakage or other damage. The distance between the bag and the supporting-frame prevents danger of the fruit coming in contact with the frame.

INVALID-BED.—J. Hall and Hattie A. Paddleford, North Monroe, N. H. This invention permits an invalid occupying the bed to void excrement, liquid or solid, while in a sitting or reclining posture through the bed-bottom and mattress into a receptacle held beneath the bed in a conveniently-removable manner. It enables a bedfast invalid to receive medical treatment for diseases of the womb and uterus, such as the application of douches, and also to afford means for bathing feet and lower limbs without exposing other portions.

WINDOW-SCREEN.—T. A. Foust and W. A. Hunter, Pittsburg, Pa. This invention refers to improvements in window-screens for excluding flies and other insects, an object being to provide a screen and novel attachments whereby the screen may be moved vertically in the window-casing and held at any desired adjustment and also be swung horizontally with relation to the casing.

FLUE OR DUCT.—H. H. Laws, New York, N. Y. In this patent the object is to provide a flue or duct made in sections adapted to be readily united and securely fastened together and arranged to present a smooth connection at the joint of the sections, to reduce the resistance to the fluid passing through the flue or duct to a minimum, at the same time strongly reinforcing the sections at the joint.

FASTENING FOR SECTIONAL TUBING.—O. P. Buckland, Liberal, Kan. Mr. Buckland's invention relates to improvements in fastenings for the sections of tubing—such as well-casings, conductor-pipes, and the like—an object being to provide a fastening of simple construction and which will give strength to the joints between sections and prevent collapsing or telescoping under pressure.

DOOR-FASTENER.—W. Box, Yankton, S. D. The aim in this improvement is to provide a fastener of novel construction that may be readily carried in a person's pocket or baggage and that may be quickly applied to a car to fasten a door, the lock, or other fastening device of which may have become defective or wholly omitted.

MEASURING DEVICE FOR GARMENTS.—A. D'Alessio, New York, N. Y. This device has arbitrarily-arranged scales thereon to be read in connection with charting of garments, which device may consist of a member for determining the measurements of garments for men and one for women, or wherein the two members, which may be independent, are arbitrarily connected by links or equivalents in a detachable manner, so that the two members will not become separated, although one is used independently of the other.

CALIPERS OR DIVIDERS.—F. H. Cawley, Vancouver, Canada. Mr. Cawley's invention is an improvement in calipers, dividers, and the like—such, for instance, as compasses; and it consists in the novel construction and combination of parts whereby the legs are supported and may be adjusted and secured in any desired adjustment. The construction is simple and easily operated.

Designs.

DESIGN FOR A PICTURE-FRAME.—V. Grazzini, New York, N. Y. This ornamental design consists of a life-buoy circle within which is placed an oval picture holder, gracefully tied about the oval and across the buoy at four equi-distant points with a band of four ropes. The design is wholly nautical. At the bottom of the buoy is an anchor and chain, and above at each side a pole with a flag.

DESIGN FOR A HANDLE FOR MIRRORS, BRUSHES, OR LIKE TOILET ARTICLES.—S. A. Keller, New York, N. Y. In this ornamental design the graceful figure of a woman half draped constitutes the handle. The arms are extended, the head poised sideways and backward, and spreading a wealth of hair. The extremity of the figure vanishes below into scroll work. Mr. Keller has patented another design. It comprises a handle for mirrors, brushes, or like toilet articles, and the ornamental features are the head and bust of a woman, the head bonneted and the body disappearing into ornamental scroll work, the latter pointed with flowers.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 5600.—For manufacturers of small ice machinery.

Autos.—Duryea Power Co., Reading, Pa.

Inquiry No. 5602.—For the necessary castings, etc., with which to build an engine for an automobile.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 5602.—For a firm manufacturing paper and pasteboard boxes and containers of various kinds.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 5603.—For a firm making tin cans, boxes and containers of same material.

If it is a paper tube we can supply it. Textile Tube Company, Fall River, Mass.

Inquiry No. 5604.—For manufacturers of iron work in bridges, girders, wire-rope transmission, pumps, motor cars and vehicles, etc.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 5605.—For manufacturers of malleable iron castings.

American inventions negotiated in Europe. Wenzel & Hamburger, Equitable Building, Berlin, Germany.

Inquiry No. 5607.—For makers of petroleum yachts or launches, not to exceed 30 feet.

In buying or selling patents money may be saved and time gained by writing Chas. A. Scott, 340 Cutler Building, Rochester, New York.

Inquiry No. 5607.—For makers of the J. Stegley patented pianos.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 5608.—For catalogues of stamped ceilings, also candle and soap factory.

Sheet metal, any kind, cut, formed any shape. Die making, wire forming, embossing, lettering, stamping, punching. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 5609.—For makers of grading machinery, also machinery for building large irrigation ditches.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 5610.—For machines for making mailing tubes of paper, with diameter of about 1 inch or more, length 1 yard or more.

Partners for Foreign Patents Wanted.—Incubator-brooder, a money-making combination. Entirely new principle. Half interest. Chas. H. Sperle, Bound Brook, New Jersey.

Inquiry No. 5611.—For machinery for making covers for paper "blocks," such as are used to roll or wind ribbon upon in silk ribbon establishments.

I have a patent on a new hook and eye, that I want to place with some manufacturer to make and market, on liberal terms.

W. A. Maxwell, Marianna, Fla.

Inquiry No. 5612.—For makers of round paper boxes for insect killer.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 15 South Canal Street, Chicago.

Inquiry No. 5613.—For manufacturers of stationary gas engines.

For Sale.—Patent, New Device. Memorandum and "Calls frequently used" attachment for desk telephones. Sheet metal cheaply manufactured. Mail order houses, light manufacturers and others investigate. Inventor, 235 Boston Block, Minneapolis, Minn.

Inquiry No. 5614.—For makers of paint-grinding machinery.

Superintendent wanted for manufacturing plant. Must be competent to take charge of machine shop—wood-working and foundry. A hustler and good organizer. References wanted. Superintendent, Box 773, New York.

Inquiry No. 5615.—For makers of electrical clocks for factories, controlled by one master clock.

Wanted.—To manufacture on reasonable terms anything in wood or metal. First-class facilities for manufacturing and shipping. Satisfaction guaranteed. Send samples for estimate. Wayland Incubator & Manufacturing Co., Wayland, N. Y.

Inquiry No. 5616.—For power boiler manufacturers.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9403) R. C. says: Will you please answer these questions in the "Notes and Queries" column of your valuable paper, the SCIENTIFIC AMERICAN: 1. What would be the result if an electric arc be attached to a 110-volt incandescent lighting circuit in a building? Would any fuses be blown or incandescent lamps be burned out? A. An arc has a drop of about 45 volts in it. If the rest of the apparatus covers 5 volts, there will be a drop of 50 volts in the lamp. An arc lamp is rated for ten amperes. This would imply about 5 ohms in the lamp. Now if such a lamp is put directly across a 110-volt circuit, it will take 22 amperes and there will be trouble directly. A short circuit will be established, and either fuses will give way or fire be set from hot wires. Incandescent lamps may receive a rush of current if on the same lines and be burned out. 2. Are there any advantages of electric welding over other methods of welding? A. An electric weld is made in less time than you can describe it. There is no burning, the heat does not extend through the metal, the machine is compact, there is little or no danger of fire, etc. There are many advantages in electrical welding. By it, scrap can be joined up into bars without remelting and forging. The weld is neatly made. 3. Will you explain what is meant by the term carbureter as applied to gasoline engines? A. A carbureter is a device in which air, or coal gas or hydrogen is passed through or over a hydrocarbon liquid, such as naphtha, in order to impregnate it with the vapor of the naphtha. The mixture is then burned or exploded. You will find in Hiscox's "Gas, Gasoline and Oil Engines," which we send for $2.50, a full description of these apparatus as found in engines. 4. Would there be any induction of current if insulated bell wires should cross insulated electric lighting wires? A. If one wire lies across another at right angles, there will be very little induction from one to the other. If a wire lies along another in which there is an alternating current flowing, there will be a strong induction in the second wire.

(9404) B. H. says: A., who has never been 200 miles north or south of Kalamazoo, claims that in the Arctic Circle the "midnight sun" is to the north and your shadow falls to the south. B., who has been inside the Arctic Circle, Klondyke, etc., claims that he saw the sun to the south and that his shadow fell to the north (midnight, of course). Who is right? A. When the sun is seen at midnight from any place in the northern hemisphere, it is seen to the north above the northern horizon. Thousands go every June to see the midnight sun from Norway. Shadows then fall to the south at midnight. This can only be seen on or within the Arctic Circle. At noon the shadows would fall to the north as usual, since the sun would then be to the south.

(9405) P. D. McC. says: Will you kindly explain through your paper the theory of oil quieting disturbed waters? A. The action of oil on the surface of the sea in a storm in preventing the waves from breaking is explained by the great surface viscosity of oil. It covers the water with a film which is more viscid than the water, and holds the waves from combing and breaking over a ship. The surface of the oil is more tenacious than that of water, and is not readily broken into surf by the pressure of the water from below. We should not express the action as quieting the disturbed waters, but as we have done above. The seas still roll, but they are smooth on the surface and do not break over the vessels. Ships can ride the seas with safety in this manner.

(9406) J. W. H. asks: Being an interested reader of your SCIENTIFIC AMERICAN, I would ask you for some information through "Notes and Queries." 1. What would be the easiest way of sinking a 5-foot caisson through 8 feet or more of quicksand? I must deepen an irrigating sump pit and have a stratum of quicksand to contend with. I have a 40-horse-power locomotive style boiler. Would it be much economy to jacket it? If so, what is the best, and I might say home-made jacket? What gage of iron or steel plate should I use in making a caisson or well curb 5 feet in diameter? A. For deepening a well with a caisson through quicksand, pressure should be applied to the top of the caisson to continually force it a little below the sand bottom in order to protect the workmen or appliances in excavating the sand within the caisson. Studding may be set around and resting on the top of the caisson, extending above the top of the well and loaded with sufficient weight to sink the caisson while the excavation is progressing. A sand pump or any convenient device may be used for removing the sand. A moderate pumping of the well may be done to relieve the resistance at the bottom of the caisson by inflow of the sand, which if too free, should be stopped by keeping the water at full height. The caisson may be made of oak or cypress staves with hoops on the outside and angle-iron bracing hoops on the inside, or may be made of three-sixteenths iron or steel with angle-iron hoops on the inside for bracing. There is considerable economy in the jacketing of your boiler and for home-made work we recommend to inclose the sides with an 8-inch brick wall to just above the center line of the shell and under the smoke jacket and front to make an air-tight chamber, then plaster the top of the boiler with ashes or sand and as little clay as will make a light plaster. Asbestos felt plaster would be better and would stick to all parts of the boiler, requiring no brick walls.

(9407) G. A. B. says: 1. Why is it you can place the hand without its being burned, on the bottom of a vessel containing boiling water and as soon as the water ceases to boil the hand will suffer a severe burn? A. A vessel containing boiling water can usually be held on the hand if the person has a good thick skin from labor or exercise, for a short time; just about long enough for the water to stop boiling. If the bottom of the kettle is covered with soot, which is a non-conductor of heat, it can be held longer than if it is clean metal. We do not think the fact that the water ceases to boil about the time the burn is felt has anything to do with the burn; it is a coincidence, merely. 2. Why is it that water boils, seemingly, easier in an old tin vessel than in a new one? A. Water boils sooner in a kettle with a rough, unpolished bottom than in one with a smooth, polished bottom. Hence it boils easier in an old tin than in a new one. 3. Why can you cut glass with shears under water? A. When glass is cut under water with shears the water seems to take the shock and hold the glass, so that the glass is chipped off without cracks running across it as we ordinarily see them do. 4. Is the temperature of steam at the bottom of the liquid boiling at a higher temperature than that at the surface? Does the temperature of the steam on the bottom vary with the depth of the liquid? Else what has the superincumbent liquid to do with the vapor pressure? A. Boiling takes place when the saturated vapor has a pressure equal to the atmospheric pressure at the time. Since the elasticity of the vapor is then the same as that of atmosphere, the vapor may be formed anywhere within the mass of the liquid. The bubbles formed below the surface rise through the liquid and the act is called boiling. Unless the fire is very hot, the entire mass, kettle and all, is of the same temperature, that of the boiling point of the liquid. We do not understand that the depth of the liquid influences the temperature of the boiling point to any extent. 5. Is there any truth in the statement that liquids when hot and thrown into the air on a cold day will fall frozen, while liquids not heated will not do so? A. Water that has been boiled and by this means deprived of its contained air, freezes more easily than water in its natural condition. But it must be extremely cold for water which is thrown into the air to fall in the frozen condition. It hardly seems credible, though water blown as spray often freezes as it strikes upon some surface. These drops are quite minute and the water is already at its freezing point when it strikes. 6. Why will not the leaves of an electroscope (gold leaf) remain diverged? Is there a remedy for it? A. An electroscope should have its metallic parts quite smooth, clean and free from dust; it then ought to retain a charge for several minutes if the air of the room is reasonably dry. The glass of the instrument should be clean and dry also. We know of no other remedies for an electroscope which does not retain its charge. 7. What could cause an electrolytic machine to cease working, after a few minutes? Could anything save a fail in potential cause this? A. You ask, "What could cause an electrolytic machine to cease working?" We take it that you intended to write "an electrostatic machine." These machines easily lose their charge by the action of the air, dampness principally. The remedy is to have the plates in a glass case and keep calcium chloride in the case to absorb the moisture. Even then, there may be occasional trouble. 8. What *two* second-class conductors with *one* first-class conductor would make a voltaic one? A. For a voltaic cell, use zinc as the positive plate, and carbon for the negative plate. The liquid may be either ammonic chloride dissolved in water, or bichromate of potash or soda, dissolved in water with sulphuric acid added. To make a battery you should have specific instructions. Our SUPPLEMENT No. 792 described a very fine battery for lectures and students' experiments. Hopkins's "Experimental Science," price $5, gives instructions in almost everything which a person engaged in teaching needs to enable him to carry on his work.

NEW BOOKS, ETC.

THE MECHANICAL ENGINEER'S REFERENCE BOOK. By Henry Harrison Suplee, B.Sc., M.E. Philadelphia: J. B. Lippincott Company, 1904. 16mo.; pp. 834. Price, $5.

Of making many engineer's pocket books there is no end, but it is seldom that we are favored with one which stays on the editor's desk for constant reference. Mr. Suplee has shown a large grasp of the subject and has performed his task in an exemplary manner, and we consider that it is indispensable to every one who is in any way concerned with mechanical engineering, or civil engineering for that matter. It is impossible to note the individual contents, but it is safe to assume that practically all the engineering data that are required are at hand. The book is a labor saver, and the "short cuts" are excellent. The book has thumb indexes, and is substantially bound. It is worthy of an extended sale, and we do not doubt that it will be a most welcome addition to the library of the engineer, old or young.

THE METRIC FALLACY. By Halsey and Dale. New York: D. Van Nostrand Company, 1904. 8vo.; pp. 231. Price, $1.

The chief points which the writer endeavors to maintain are these: That, as shown by the experience of other countries, the changing of a people's system of weights and measures is a task of enormous difficulty, attended by widespread confusion; that the retirement of the inch and the substitution therefor of the millimeter involves the destruction of all mechanical standards; that the prosperity of foreign trade in nowise requires the adoption of the metric system as a basis of manufacture; that the system has for industrial purposes no such superiority as is claimed; and that the claims for the saving of time in calculations and in the school life of children are completely negatived by the certainty that, here as elsewhere, the old units will persist in use and must be learned; that the confusion which is said to exist in our weights and measures is a fiction; that, measured by the number of units in common use, and by their uniform value in all sections and all industries, we have the simplest and most uniform system of weights and measures in the world. Whether Mr. Halsey's arguments are sufficiently strong and well presented to convert the pro-metric mind or no, the reader can scarcely doubt his earnestness and sincerity. Mr. Dale's contribution to the work is an exhaustive consideration of "The Metric Failure in the Textile Industry." It shows knowledge and research, makes interesting reading, and is certainly worthy of notice as an able presentation of "the other side of the question."

DIE VERWERTUNG DES SPIRITUS FUER TECHNISCHE ZWECKE. Von Prof. Dr. N. Wender. Mitt 88 Abbildungen. Large 8vo. Price, $1.50.

Low-grade alcohol is destined to become of great industrial value as an engine fuel. Up to the present time there has been no work in German in which the technical utilization of alcohol has been discussed with anything like the thoroughness technologists demand. The present book seems well calculated to supply this want. After treating of the method of utilising alcohol in various countries, the author describes methods of producing alcohol, alcohol illumination, alcohol cooking and heating apparatus, alcohol motors and locomobiles. In a brief chapter the author reviews the utilization of alcohol in chemical industry.

FISCHWEGE UND FISCHTEICHE. Die Arbeiten des Ingenieurs zum Nutzen der Fischerei. Von Paul Gerhardt. 142 illustrations. Leipzig: Wilhelm Engelman, 1904. 8vo.; pp. 147. Price, $2.

Since the publication of H. Keller's "Die Anlage der Fischwege," in 1885, no notable scientific book on what may be termed the engineering side of fishery work has been published. The present book is, therefore, rather a timely addition to the literature of an art that of late years has grown in importance. Mr. Gerhardt has confined his investigations not merely to Germany. He has studied the construction of fish weirs and ponds abroad, and has made many an interesting comparison with similar structures of his own country. His book may well be considered an excellently prepared scientific treatise on a subject which in this country has been discussed, so far as we know, only in the reports of the United States Fish Commission.

A CLEAN CHIMNEY. The Economical Burning of Coal Without Smoke, with Especial Reference to the Use of Washed Coal. By A. Bement, Member American Institute of Mining Engineers, etc. Published for private circulation by Peabody Coal Company, Chicago, 1904. 8vo.; pp. 48.

The efficiency or inefficiency of bituminous coal is generally supposed to depend almost entirely upon the chemical characteristics of the coal and the construction of the apparatus used in consuming it. As a matter of fact, the method of operation, while generally slighted, is also of high importance. It has been the aim of the writer to show how the costly evils of incomplete combustion, the loss of coal and coke removed in the ashes, and the escape of heated gases, may be remedied by scientific operation and manipulation. The chapter setting forth the valuable features of "washed" coal deserves the careful consideration of firemen, engineers, and proprietors.

CHEERFUL AMERICANS. By Charles Battell Loomis. New York: Henry Holt & Co., 1903. 8vo.; pp. 300. Price, $1.25.

"Cheerful Americans" is a volume of short stories in Mr. Loomis's usual cheerful style. All the yarns have appeared at different times in different well-known periodicals, and are here collected and reprinted for the delectation of Americans who are already cheerful, and the conversion of those who are not. The humor is of the quiet, good-natured kind, dependent as much on character as on situation. The fads and follies of humanity are sketched for our amusement, but there is nothing caustic or cynical in the manner of their presentation. Well-executed drawings by popular illustrators heighten the enjoyment of the reader.

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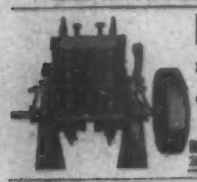

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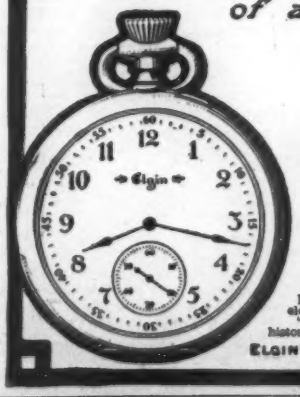

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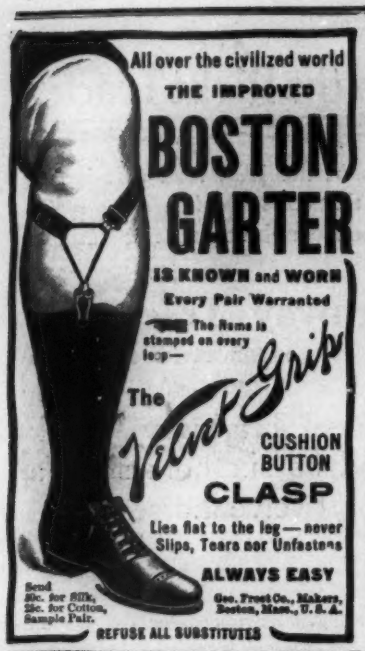

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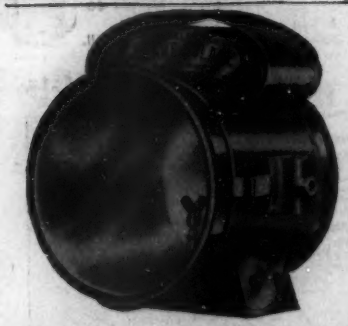

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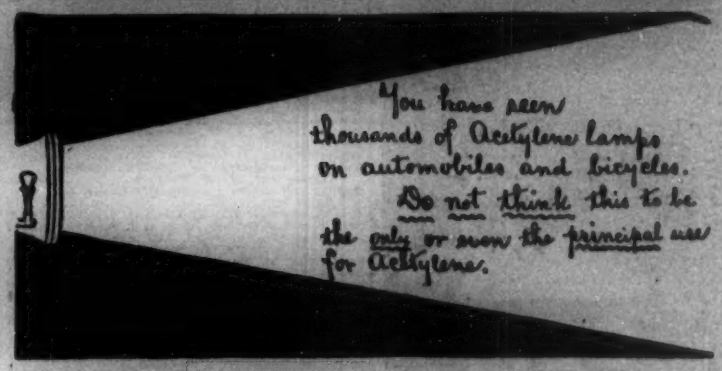
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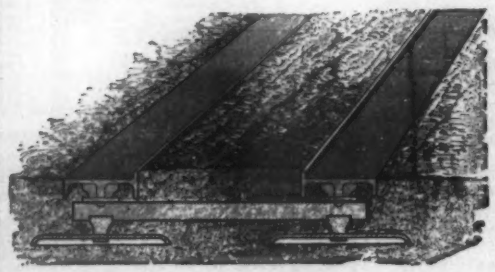

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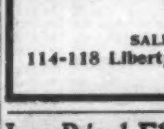

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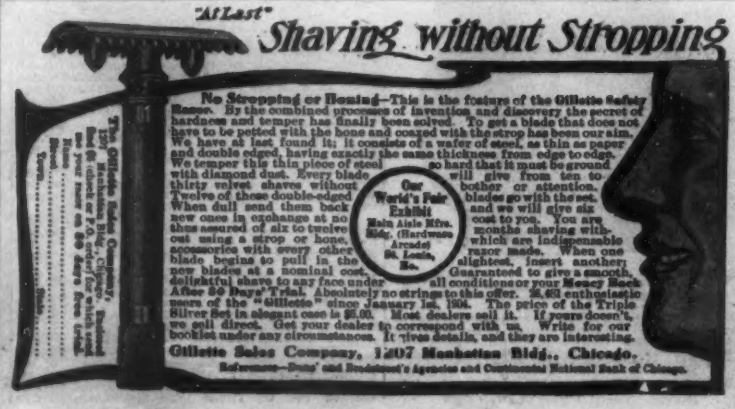
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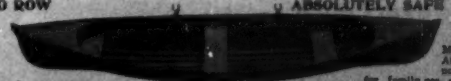

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